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The Green Thumb



Spring 1983

Vol. Forty
Number One



The Cover

Early Risers

Frances Frakes Hansen

The Green Thumb

Spring 1983

Vol. Forty, Number One

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Elma A. Richards
Editor

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Denver Botanic Gardens, Inc., maintains a collection of living plants, both native and exotic, for the purpose of acquiring, advancing, and spreading botanical and horticultural knowledge.

This is a non-profit organization supported by municipal and private funds.

Horticulture in Therapy and Rehabilitation

Merle M. Moore

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"Gardening is to me an escape from artificiality into the sane world of order and balance. It gives me a feeling of security and satisfies the primitive need for the assurance of unchanging fundamentals. In my garden I find never shifting values. I find the eternal laws of the universe in tangible form. Gardening makes me humble, for in my garden I work with a force far stronger than I. When I realize that flowers absorb color and perfume from within a dimension beyond my understanding, my belief in God is strengthened. Gardening satisfies my hunger for spiritual beauty and creation. If ideals seem futile, if friends disappoint me, if my heart is sad, or my mind in turmoil, if my eyes are dull and my body sluggish, I can go into my garden and find faith, tranquility, comfort and physical exercise, all of which gives me a feeling of well being."

—Jessie Morris

Rarely do people go through life without the memory of a horticultural experience: the first dandelion of spring poking through a crack in the sidewalk; the fragrance of a rose blossom; an African violet flowering on the window sill. From the moment of birth, we interact with our environment, exploring nature through our senses—visual, auditory, olfactory and tactile. It is this very willingness to interact with plants in our environment that makes horticultural practices and experiences useful in therapy and rehabilitation.

Alice Burlingame, a noted author, lecturer and instructor on the subject of horticultural therapy, wrote in *Gardening Offered as a Therapy*: "What do you do in horticultural therapy? You develop a program of working with flowers and plants, with the primary objective being to raise the level of motivation for the patient, whether his problem be mental or physical.

Response will come from the patient in a renewed confidence, a warm feeling of achievement and a greater interest in tomorrow than in yesterday."

The use of gardening activities to treat certain illnesses is by no means a new concept. Dr. Benjamin Rush noted in 1812 that "digging in the garden" was one of the activities that often lead to recovery of patients in mental hospitals. During the late 1800s horticulture gained acceptance as a means of easing the stressful lives of poor inner city residents and teaching individuals who were retarded. With the establishment in the early 1900s of the Menninger Foundation in Topeka, Kansas, plants, gardening and nature study became integral parts of the patients' activities. Dr. C.F. Menninger wrote in 1942: "...Healthy flowers have no aches and pains. They make no outcry and there are no anxious and troubled faces to comfort. They just grow and bloom. They have helped me to keep my emotional and intellectual equilibrium... Hope never dies in a real gardener's heart."

One of the important purposes for developing, at Denver Botanic Gardens, the George R. and Pauline A. Morrison Horticultural Demonstration Center within Community Gardens Square is to promote a greater awareness of the therapeutic value and adaptive qualities of horticulture. This will be accomplished through workshops for professionals, public tours of the facility and direct contact with the handicapped community in Denver. Workshops will be held to train staff and volunteers of various facilities in horticultural theory, techniques and practices. Staff from the Center will consult with staff from facilities where there is an ongoing horticultural therapy program or interest in starting one. A survey compiled in early 1982 by Lynn Hershock, horticultural therapy intern, indicated that of those

contacted from the more than 50 facilities in Denver, 94 percent expressed interest in participating in training opportunities to be offered at the Morrison Horticultural Demonstration Center. A surprising result of the survey was that 10 percent of the facilities contacted have had previous plans to build a greenhouse and 10 percent already have greenhouse space available. Twenty-four percent of the facilities contacted have had either a garden or indoor plant program. The Morrison Horticultural Demonstration Center will be an important resource both for those facilities in Denver already using gardening in their treatment programs and for others who want to introduce this innovative approach to therapy and rehabilitation. The Center will also be open to the public to enable visitors to

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“...a warm feeling of achievement...”

observe and experience adaptive architectural and gardening techniques.

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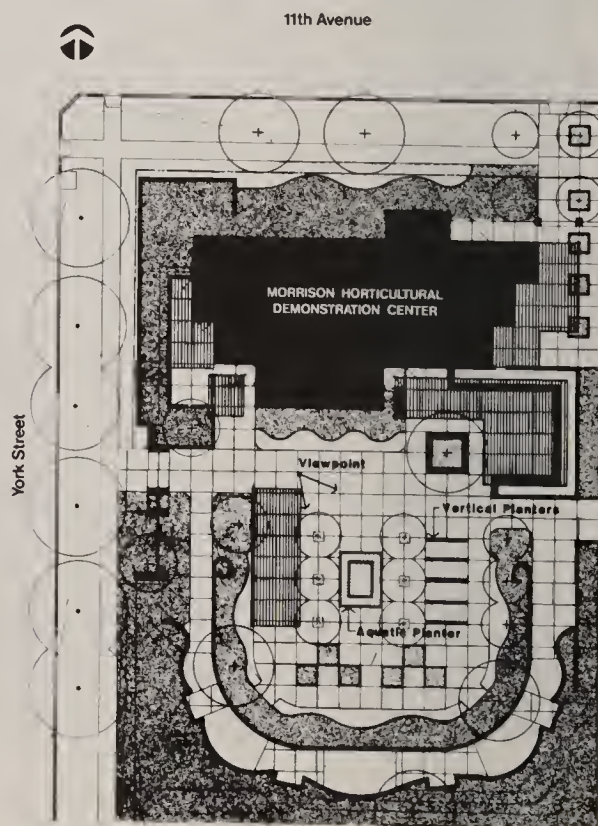
The Morrison Horticultural Demonstration Center is located on the corner of York Street and 11th Avenue. The facility, designed to be entirely accessible when completed in mid-1983 will offer a learning environment for individuals and groups. Designed by Ronald K. Abo of Abo Gude and Associates in partnership with Brooks Bond of the Solar Design Group, the Center consists of a building containing meeting and workshop-activities space and offices as well as an attached passive solar greenhouse. With a fully accessible kitchen, adaptive greenhouse controls and specially designed tools, the building will offer total physical independence for the majority of people who will use it.

Adjacent to the building is a similarly accessible landscaped demonstration garden designed by Herbert Schaal, principal landscape architect, and his staff at EDAW in Ft. Collins. The same carefully researched and precise planning that went into the EDAW-conceived Rose Garden and Rock Alpine Garden within the main Botanic Gardens complex is evident in our design for the Horticultural Demonstration Center Garden. A "sensory par-course" around the perimeter of the garden combines architectural and plant features designed to stimulate, at appropriate interpretive points along the trail, the multiple sensory stimuli of **fragrance and taste** (a predominance of herbs and vegetables); **sound** (running water, plants to attract birds, trees with leaves that rustle in the wind); **touch** (plants having interesting leaf and bark textures); and **sight** (bold colors in

flowers and foliage). In addition to their sensory impact the plantings throughout the garden will provide material for use in nature craft projects such as making potpourri and arranging fresh and dried flowers.

Elsewhere in the garden adaptive gardening techniques will be demonstrated, such as producing fruit on dwarfed and espaliered trees—a French technique which, properly applied, enables a wheelchair-bound person to maintain the entire tree unassisted. Raised beds and planters of different types will demonstrate means of making gardening easier for wheelchair-bound persons or others who may have difficulty bending or kneeling.

The Morrison Horticultural Demonstration Center is part of the larger Community Garden Square Project. When completed, over 300 gardeners will be able to participate in the annual community gardening program in an area bounded by York Street on the west, Josephine

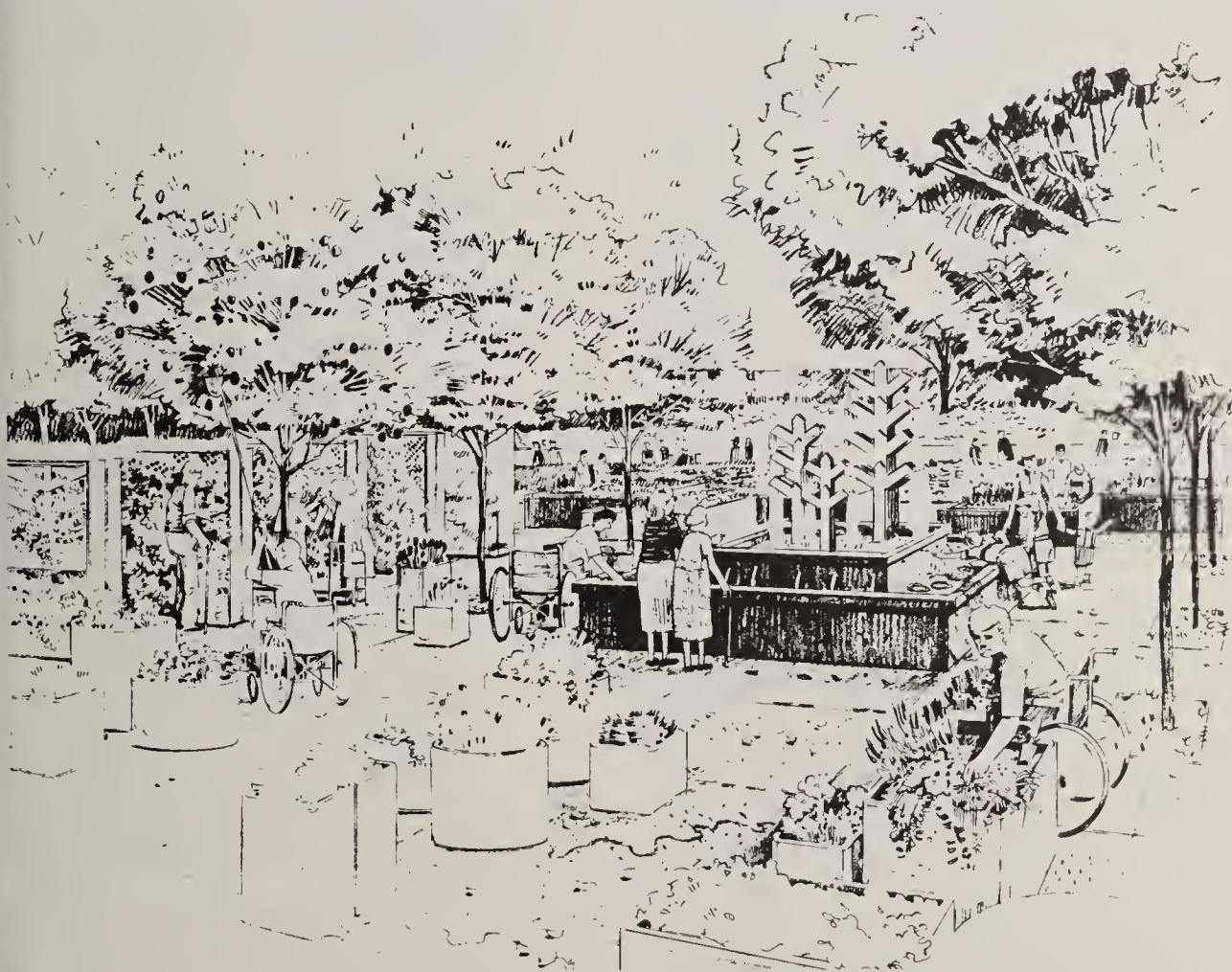


Street on the east, 11th Avenue on the north and Botanic Gardens' parking lot on the south. The newly added community garden space, which has been designated the Lawrence A. Long Community Garden, will include several raised beds to facilitate integration of the training programs being conducted in the Horticultural Demonstration Center with the Community Gardening Program.

In April 1973 The National Council for Therapy and Rehabilitation Through Horticulture (NCTRH) was formed in the Washington, D.C. area. The First Annual Conference of the Council was held in Washington on November 6 and 7, 1973, with over 200 participants. I was fortunate to be present at that conference where I presented a paper on the horticultural therapy program at The Holden Arboretum

for which I was working at the time. As a charter member of NCTRH, a member of the board of trustees of the organization for several years and its president from 1980 through 1981, I have seen the Council grow significantly in size and influence within the professional community. Today, with a membership of more than 700 nation-wide and abroad, it serves the needs of persons working with horticulture as a rehabilitative and therapeutic medium in programs for the treatment of the mentally ill and disabled, the physically handicapped, nursing home residents, drug abusers, prisoners in correctional institutions and many other handicapped and disabled persons. Plans are underway to form an affiliated state chapter of NCTRH to increase communication among those individuals and institutions in Colorado who are

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“...a garden equally accessible to all persons.”

presently utilizing horticulture in their treatment programs or who seek more information on the subject. We anticipate that the Morrison Horticultural Demonstration Center will become the focal point for training, demonstration and dissemination of information on horticultural therapy throughout Colorado and the Rocky Mountain region.

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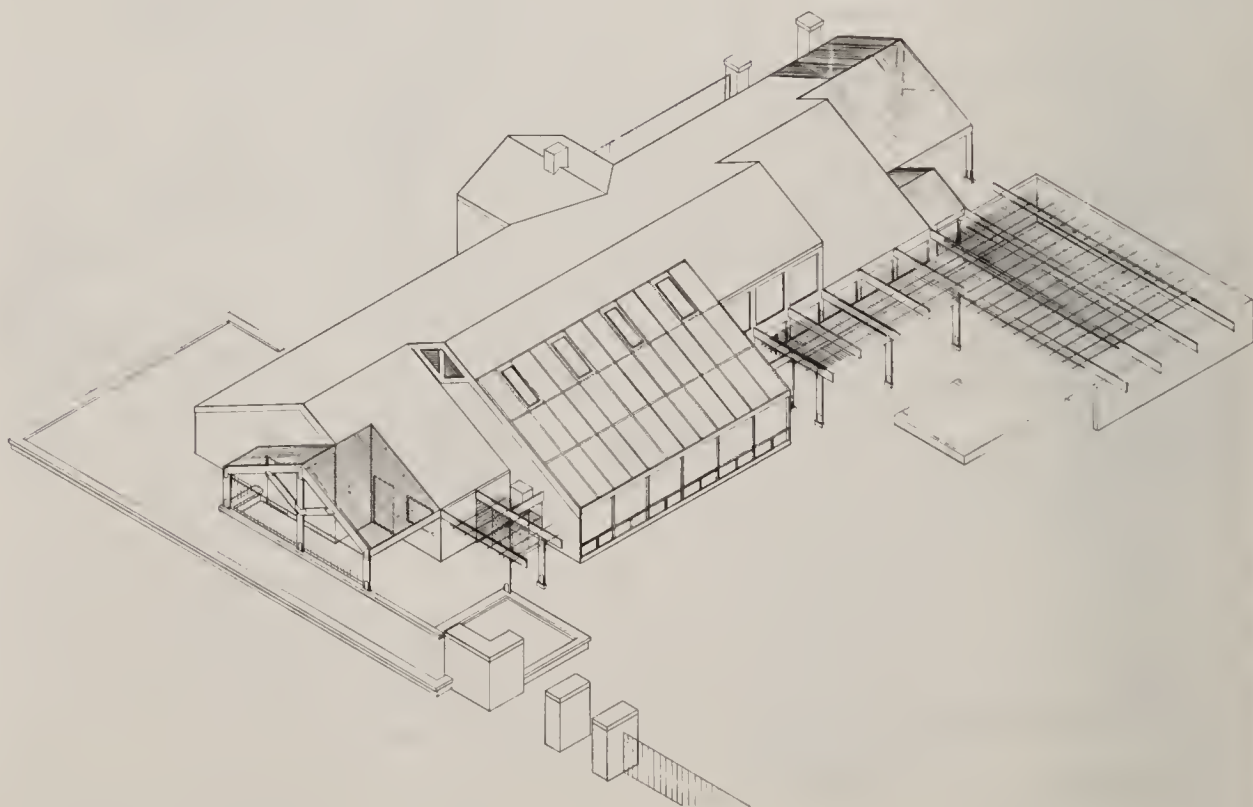
In building this important new facility we are not creating a garden for the handicapped but rather a garden equally accessible to all persons, including the handicapped. Rachel Carson once wrote: "Those who contemplate the beauty of the earth find reserves of strength that will endure as long as life lasts." Within Community Gardens Square and the Morrison Horticultural Demonstration Center will be found the resources necessary to instill in each individual's personal experience the awakening of the spirit alluded to by Jessie Morris and

Rachel Carson. I cannot think of a more suitable goal for an outreach and community service program of Denver Botanic Gardens. ☐

For further information about horticultural therapy, the Helen Fowler Library has an extensive collection of articles, journals, pamphlets and books on the subject. Especially recommended are *Therapy through Horticulture* by Watson and Burlingame and the newsletters of The National Council for Therapy and Rehabilitation Through Horticulture. Editor.

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Morrison Horticultural Demonstration Center

Community Garden Square

John Brett

Community Garden Square is the culmination of years of evolution, hard work, and the creative urge that has made Denver Botanic Gardens a leader in innovation among botanic gardens. From its beginning in 1960 as a children's garden, to the dynamic, exciting reality that it is now, it has continually changed and grown. Growth and change are necessary because, when working with people within a community setting, needs, goals and aspirations change. Therefore an innovative program also changes to reflect and administer to those needs and goals. Community Garden Square's location between York and Josephine Streets, south of 11th Avenue and north of the parking lot makes it one of the most visible portions of the Gardens. By its nature it will be a major outreach effort into the community both locally and regionally.

Gardening for people in the local community has been a priority for Denver Botanic Gardens since it first moved to this site in 1960. The children's garden was a highly successful program for 17 years when, due to lack of interest, changing neighborhood demographics and deteriorating soil conditions, it was discontinued. Two other gardening ventures were attempted. Begun at Barrett School



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Success!

in 1975 was a program almost identical to the one at York Street; the other was a youth program for young teenagers begun in 1976. The youth program was more advanced than that for the younger children and was designed to build on the experiences from the earlier gardening efforts. These gardens did not achieve the success of the first project and were also discontinued. The current family-adult oriented program evolved from these other gardens.

Community Garden Square will be a blend of gardens and activities. On the south end will be the Ruth Porter Waring Community Garden and along the east side will be the Lawrence A. Long Community Garden providing about 150 community garden plots. These plots are most frequently used by members of the neighborhoods in

John Brett, a staff member of Denver Botanic Gardens for six years, is Community Gardens Coordinator.

the vicinity around the Gardens where apartments and condominiums are the predominant housing. Unlike many "vacant lot" gardens the plots at Denver Botanic Gardens will be permanent and not subject to the vagaries of development. This is part of the growing national trend to promote and develop community gardens as a viable and legitimate land use, especially in urban areas.

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Shared Gardening

A number of exciting features make this garden interesting and educational. The Morrison Horticultural Demonstration Center will demonstrate, teach and conduct research on the theory and practice of horticulture as a tool in therapy. A garden with a number of different and interesting features not often used in landscape design will surround the building and extend to the south. The focus of this garden will be not only aesthetic but also functional with one of its fundamental principles, accessibility. The aim is to demonstrate that gardening can be made available to a much larger segment of the population than usually has access to it.

Movable planters and raised beds, dwarf and espaliered fruit trees and vertical gardens all demonstrate

space saving, flexible and adaptive gardening techniques. The "sensory par-course," one of the most distinctive design features in the entire garden, is a horseshoe shaped walkway sloped on the front side and walled on the back side, that will use design elements and plant materials specifically to challenge and delight the senses. Plants to touch, see, hear, smell and taste will be featured segments along the course with sensory cues for orientation provided throughout the gardens. There will be outdoor workspaces for demonstration and teaching, a small amphitheater for program presentation and other activities, as well as "active" spaces in which people may move about.

An important concept of Community Garden Square is the integration of the activities of the Morrison Horticultural Demonstration Center and the Community Gardens Program principally by providing gardening opportunities for those members of the disabled community who are capable of such sustained activities. This will be facilitated by the use of raised beds, hard surface paths and adapted tools. Once again Denver Botanic Gardens will be meeting a previously unfulfilled need.

In keeping with our tradition of introducing creative new gardens to the Denver area, Community Garden Square will be a unique, dynamic addition to Denver Botanic Gardens. During the capital campaign "To Fulfill a Promise" this garden was described as a "participatory garden," a term which sums up the true nature of the area. It will be a garden whose definition is determined by its function, a garden where participation is not only encouraged but required to fulfill its stated purpose. □

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Miniature Roses— at Home and at the Gardens

Linda Brown

The popularity of miniature roses among home gardeners is steadily increasing. Each year hybridizers are introducing more and more of these healthy, hardy plants for us to add to our outdoor and indoor plant collections.

Outdoors these decorative little shrubs can enhance our landscapes by our planting them in the garden as borders or mixing them with other perennials and annuals. They also can be very effective when used outdoors in container-type gardening. Indoors, when conditions similar to those outside can be simulated, miniature roses will thrive for year round beauty.

Miniature roses offer us a broad, diverse selection of varieties. Any color in other roses can readily be found in miniatures. Flower form, plant size and plant shape also add to this variety. Some miniatures such as Dresden Doll, Fairy Moss,

Paintbrush and Kara are even mossed. In general, any characteristic in other roses can be found here in a scaled-down version.

One of the distinct advantages of miniatures (minis) is their minimal space requirements. Full-grown miniature plants can range from 5 to 18 inches in height. A favorite "micro-mini" is Si, white to a very pale pink at times with blooms from 1/4 to 1/2 inch across when fully open. In contrast, a Beauty Secret plant can reach 18 inches easily in a growing season and produce masses of deep red, fragrant blossoms measuring about 1 1/2 inches across when open. Since its foliage is fairly dense Beauty Secret, when placed at 12 inch intervals, can create an attractive border planting because of its size and growing habit. Pop-corn, a floribunda style mini, grows to approximately the same height as Beauty Secret and can easily be adapted to border plantings or mass plantings. Clusters of snow white, small, single blooms cover this variety for most of the growing season. Size variation in minis plus the differences in blooming habits should definitely be considered in plant placement and selection.

Linda Brown, volunteer supervisor of the Miniature Rose Test Garden at Denver Botanic Gardens, is Rocky Mountain district director of American Rose Society; immediate past president, Denver Rose Society and past president of the Arapahoe County Rose Society.

Plant growth habits range from low spreaders to climbers. Miniature climbers can be trained to posts, trellises and fences just as other climbing roses can. During the first year blooming may be sparse but the foliage can provide a good background until plants are well established. Pink Cameo, Hi Ho and Jeanne Lajoie are three hardy miniature climbers that will bloom intermittently throughout the season. Red Cascade is an example of a low spreader. It will produce many lateral side shoots and can be used as a ground cover or to drape a bank. Snow Carpet is another good ground cover.

The old-fashioned type flower form often appears in modern day miniatures. The many-petalled varieties such as Mimi, a pink "cabbage" rose, offers a distinct contrast to the single varieties. Simplex is an outstanding single with five ivory petals surrounding a center of golden anthers. Anytime is another single with orange petals that appear pinched at their hinge.

The more modern hybrid tea flower form with its high centered bloom is also well represented among minis. Rise n' Shine has yellow blossoms of excellent form on a vigorous, healthy bush. These flowers will last well when cut. Another is Toy Clown, silvery white petals edged in red; this is often a rose show

winner. Other examples are Magic Carrousel, Dreamglo, Starina, Mary Marshall, Peaches n' Cream, Sheri Anne, Pink Petticoat and Kathy Robinson.

The ruffled or cupped flower form is found in such varieties as Bo Peep, Scarlet Gem, Cinderella and My Valentine. Tiny Warrior, dark pink, has an unusual square shaped center as it opens. Many of these also display hybrid tea characteristics during various stages of development.

Baby Ophelia, a pink blend, has a distinct old rose fragrance. Fragrance is apparent in others such as Beauty Secret, Yellow Doll, Lavender Lace and Mary Adair. Many minis have a slight to moderate fragrance; although many have little at all.

Culture

Their cultural practices are similar to those of other roses. Because a majority of miniature roses are on their own roots they often prove hardier than their larger counterparts. Subject to the same pests that afflict the larger roses they respond quickly following appropriate care.

Good drainage is essential whether the planting is in the ground or in a



container. A loose, crumbly soil with humus that any plant would thrive in will serve miniature roses well. Humus added in an amount up to one-third of the total volume should be adequate to start plants off well and to help maintain the moisture level in the soil. They need to be moist but not water-logged throughout the entire growing season.

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Fertilizing must be approached with caution. Requirements are much less than for the larger varieties. Some hybridizers even feel that no feeding is necessary when soil has been prepared properly. About a tablespoon or less of rose food applied per plant two to three times during the growing season is ample.

Spider mites, the most prevalent insect problem, are usually controlled with sharp sprays of water directed toward the undersides of the leaves and applied two or three times a week. If the problem persists a miticide such as Vendex, Plitran or Kelthane used according to manufacturers' directions will help to restore plants to good health. As for fungus and mildew, Funginex or any other fungicide recommended for use on roses can be used regularly to prevent these problems.

Given 4 to 6 hours of good sunlight, good soil, moisture, and awareness and care if pests are present,

miniature roses will grow and thrive and provide an abundance of beautiful, colorful blooms throughout the growing season.

Test Garden

In 1980 the American Rose Society designated Denver Botanic Gardens the site of the fifth miniature rose test garden in its national "E for Excellence" award program. Our first entries were received in May of that year and planted in the raised beds at the north end of the AARS test gardens. The growing medium is a prepared mixture of equal parts garden soil, peat moss and squeegee sand. Watering is by trickle irrigation. The roses receive minimal care in our attempt to approximate conditions found in an "average" home garden.

During the growing season an evaluation team reviews the entries once a week to consider bud and flower form, color, substance, bush habit, quantity of flowers, foliage, disease and insect resistance. The test roses are evaluated for a two year period so half of the garden is new roses of less than a year's growth and the other half is in its second growing season. At the end of the second growing season and after scores from the five test gardens are compiled the "E for Excellence" is awarded to the outstanding entry or entries for that period.

Since the inception of test trials at Denver Botanic Gardens we have observed and evaluated the following winners: 1981—Party Girl and Pacesetter; 1982—Cornsilk, Cupcake, Valerie Jean, Snow Bride, Hombre.

The 1983 test trials will cover 29 entries. Both amateur and

professional hybridizers will provide three bushes of each entry. These will be planted in May and ready for evaluation starting in June.

Some Old Favorites

Red/Orange

Beauty Secret
Zinger
Starina
Kathy
Sheri Anne
Chattem
Centennial

White

Cinderella
Easter Morning
White Angel
Green Ice
Popcorn
Starglo

Yellow

Rise 'n' Shine
Yellow Doll
Little Linda

Mauve

Lavender Jewel
Lavender Lace

Pink

Judy Fischer
Jeanne Lajoie
Baby Betsy McCall

Blends

Mary Marshall
Pink Petticoat
Janna
Magic Carrousel
Lady Eve
Stars 'n' Stripes
Peaches 'n' Cream
Over the Rainbow
Puppy Love

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The Genus *Tillandsia*

Gary Davis

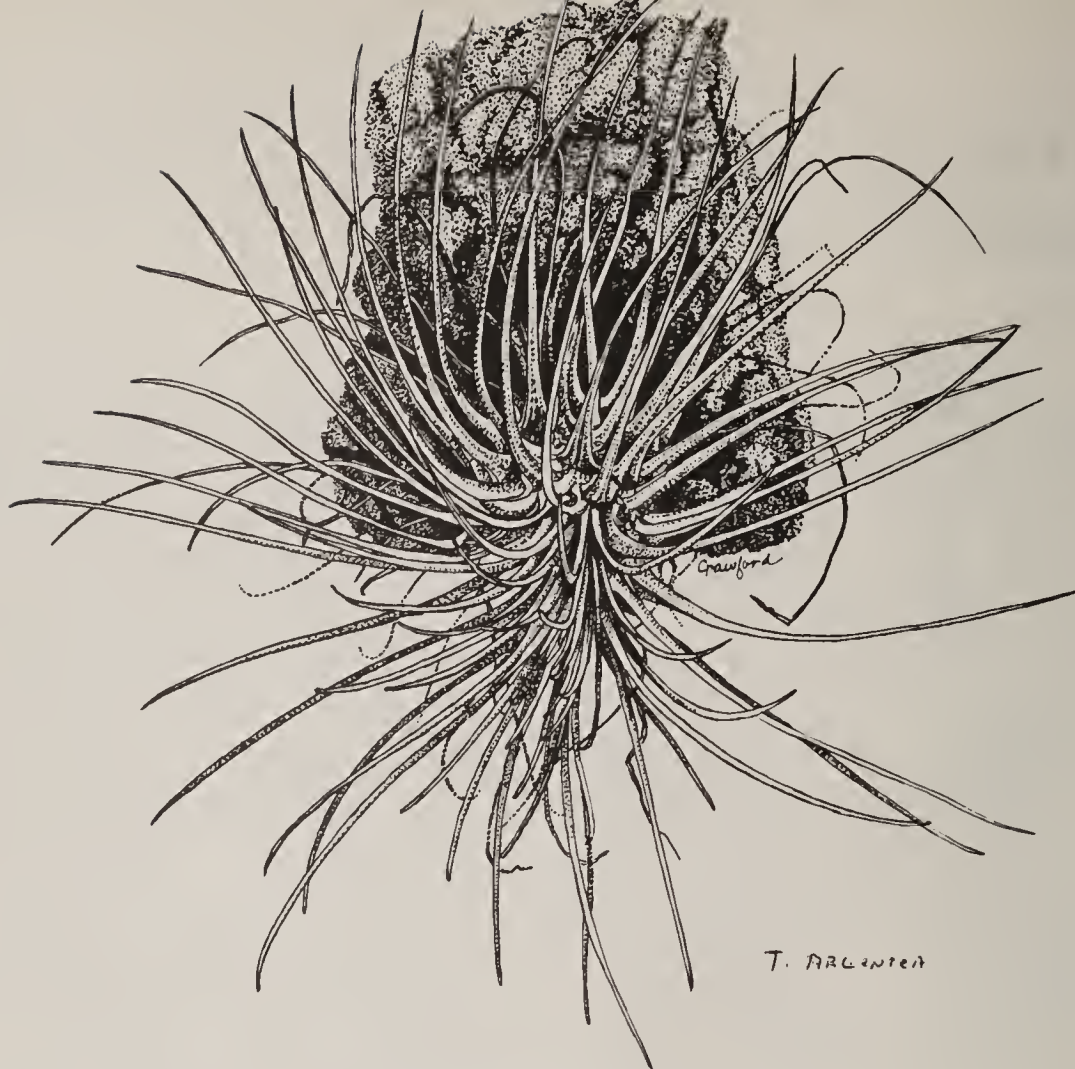
The genus *Tillandsia*, composed of more than 500 species, is the largest and most diverse genus of the bromeliad family. As with all members of this plant family tillandsias are found only in the New World, with a range from southern United States throughout the West Indies, Cuba, Mexico, Central and South America to just 500 miles north of the southern tip of Argentina. Tillandsias thrive from sea level to about 4000 meters (12,600 ft.) with temperatures ranging from near freezing to 90 degrees Fahrenheit or even higher. Their habitats vary from moist and shady to extremely dry and hot conditions.

Nearly all tillandsias are epiphytic (growing on another plant), though some may be terrestrial (growing in the ground) or saxicolous (growing on rocks). Quite a large number of tillandsias are xerophytic growing in dry situations and subsisting with a small amount of moisture, often lying on shifting sands in some remote desert. They may grow as a single, beautiful specimen or in clumps with as many as 50 plants forming a spectacular silvery cushion. Generally speaking, tillandsias are the most unusual and adaptable of all the plants in this interesting family.

Basically, there are two types of tillandsias: the silver or gray succulent type found in semi-arid

climates, and the soft green-leaved tank types found in areas with more precipitation. In order for plants of this genus to survive under such diverse conditions, special characteristics have evolved, the most outstanding of these being the development of trichomes (also called "hairs" or "scales" in Bromeliaceae). These hairs or scales can cover the entire leaf surface, appear in bands or stripes, or can be so indiscernible a magnifying glass is necessary to see them. Depending on habitat, trichomes serve either as a protective agent or as an aid in water absorption or both. A trichome consists of two parts, the shield and the water absorption cells. When the plant is dry the shield covers the cells to prevent evaporation. When the plant is wet the shield expands and the absorption cells are filled with water.

When speaking of trichomes, one must also consider the roots—or lack of roots—on tillandsias. The main function of their roots is to anchor the plant to its particular host, which may be another plant, a rock, a cactus, or even a telephone wire. These plants are not parasitic; that is, they derive no sustenance from the host. This makes the function of trichomes that much more important, as the absorption of water and nutrients is accomplished primarily by these scales, particularly in areas where natural precipitation is very sparse. In areas where natural precipitation is more abundant tillandsias have developed another means of water conservation:



Tillandsia argentea

the tank which is a vase-like, water-holding area in the center of the rosette formed by the clasping leaf bases. These tanks enable the plant to store enough water and nutrients to get them through times of little rainfall.

At Denver Botanic Gardens we have quite a large number of tillandsias of both types mentioned above. Through years of trial and error and careful observation I recommend a few species of tillandsias suitable for local greenhouse or houseplant culture. With a few simple alterations in one's greenhouse or home many fun and rewarding hours may be spent growing these beautiful plants.

***Tillandsia argentea* Grisebach**

A natural epiphyte forming a tiny, silvery tuft of narrow, soft gray leaves no more than 2 inches long,

resembling a pincushion ball measuring about 2 inches in diameter. A simple rose-colored inflorescence bears up to six bright flowers with purple petals.

Culture: bright light (west or south window); humidity at about 20-50 percent; mist once a day in spring through autumn, three times a week in winter.

***Tillandsia brachycaulos*
Schlechtendal**

A natural epiphyte with about 30 channeled, recurving, green leaves, 6-9 inches long and about ½ inch wide at the base tapering to a point. A loose rosette is formed with about a dozen or more bright lilac-petaled flowers forming a head in the center. At flowering time, the whole plant turns a glowing red.

Culture: same as for *T. argentea*.

***Tillandsia cacticola* L. B. Smith**

Another epiphyte growing on various species of cacti in its native Peru, this gorgeous plant is one of the easiest and showiest of the tillandsias. Whitish-gray leaves about 1 inch wide and 12 inches long form a beautiful rosette. Out of this emerges a flower stalk to 20 inches in height which bears five to six fan-shaped, lavender-pink bracts with a delicate sheen resembling mother-of-pearl. Flowers are ivory with blue tips, long-lasting and very fragrant.

Culture: bright light; 10-50 percent humidity; water once a day spring through autumn and three times a week in winter.

***Tillandsia cyanea* Linden**

One of the most desirable members of the genus for cultivation because of its compact form and brilliant, long-lasting inflorescence. Forty to

sixty thin grass-like leaves 1-1½ feet long form a graceful rosette. The inflorescence, a fan-shaped head 4-6 inches long, 2 inches wide and comparatively thin, is of the brightest rose with large brilliant blue flowers emerging singly or in pairs along the spike.

Culture: does well mounted or potted in a loose potting mix; medium to bright light but not direct sunlight; 50-80 percent humidity; if in a pot, water twice a week spring through autumn, once a week in winter; if mounted, water once daily spring through autumn, three times a week in winter. □

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T. CYRRELL

Tillandsia cyanea

Soil Building Plants for Colorado Gardeners

Joann Narverud

A soil building plant can be any plant that increases the soil's percentage of organic matter, provides the soil with protection from the forces of erosion, improves the soil's rate of percolation or improves its moisture holding ability. Soil building plants are often called **green manures** referring to their soil amending properties, or **cover crops** referring to their abilities as erosion control plants. They are typically quick growing and have tough, extensive root systems. In a well planned soil building program the remains of vegetable gardens and annual flower beds can also contribute significantly as soil builders. Most soils will benefit through the implementation of soil building programs; for example, clay soils can be made more workable, sandy soils can be made to hold more moisture, and alkaline soils can be acidified. Soil improvement programs of at least two years in duration can be used with great success in vegetable gardens, flower beds and in areas where the soil structure has been destroyed.

Joann Narverud has been on the horticultural staff of Denver Botanic Gardens for five years following a five month high school internship in 1977.

Green Manures

This group of soil builders is used primarily to increase the friability of the soil and to improve the rate of percolation by increasing its porosity. The best plants for green manures are members of the legume (pea) family, which have the ability, through the action of bacteria on their root nodules, to fix atmospheric nitrogen at the rate of up to 100 pounds per acre per year. Although legumes such as alfalfa and the clovers make the best green manures, the foliage of most plants contains appreciable amounts of nitrogen, phosphorous and potassium, and when turned under serves as an excellent soil amendment. For maximum benefit of nitrogen fixation, legumes should be turned under when the flower buds appear.

When organic matter is incorporated into a clay soil the resulting soil is easier to work due to its larger pore space. Adding organic matter to a sandy soil improves its ability to hold moisture because its porosity has been decreased. All soils will be richer in available nutrients and micro-organisms. Organic matter acts as a

buffer against both excess acidity and excess alkalinity and can be incorporated in great quantity without harming the soil. Many soil building plants have roots that can penetrate the worst hardpan conditions. As these roots grow into the hardpan, water is able to percolate through allowing the less vigorous roots of trees and shrubs to enter it with greater ease. Green manures should be of particular interest to Colorado gardeners as they provide attractive, inexpensive drought tolerant means of improving and rebuilding soils.

Cover Crops

Soil building plants also function in erosion control. There are basically two types of erosion: splash erosion caused by rain or overhead irrigation, and sheet erosion caused by strong winds and flooding. Both types can be effectively controlled by using plants with dense foliage and strong root systems. Throughout the growing season, the dense foliage of cover crops cushions the water droplets and channels them gently to the ground allowing moisture to percolate through the soil without surface compaction. During winter months roots and decaying foliage anchor the top soil, thus protecting it from our sometimes devastating spring and winter winds. With a little help from soil building plants our precious top soils can withstand the forces of erosion.

Soil Building Programs

Soil improvement programs can be tailored to fit the needs of the individual gardener. Two full growing seasons give the roots of cover crops time to penetrate completely the hardpan layer; and the tops when incorporated into the soil the following spring will have time to decay before planting begins. Soil

building plants should be used as part of an ongoing program to protect and replenish the soil in all vegetable gardens and flower beds. Quick growing green manures such as clovers and other legumes can be planted after some of the early to mid-season crops have been harvested and will protect the soil during the winter months while enriching it with their nitrogen-fixing ability. Rather than allowing unplanted areas to lie fallow and exposed to the forces of erosion, seed an attractive soil building plant and turn it under the following spring or fall thus increasing organic matter content while protecting that all important top soil.

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Basic Soil Building Plans

Flower and vegetable gardens:

Seed one of the plants recommended in the following section in mid-September after turning under any disease-free vegetable or flower remains. Turn this green manure under as soon as the soil is workable the following spring. Before incorporating any plant material, high nitrogen fertilizer or well-rotted manure may be added to speed the decaying process.



Strawberry Clover

New housing developments:

Most new developments have little if any top soil left and what remains is usually extremely compacted. The soil in these areas should be built up over a period of at least two years before permanent plantings of trees, shrubs or turf are initiated. Cover crops should be seeded each spring and fall after the previous crop has been incorporated into the soil. In cases where the hardpan layer is more than 3 inches thick, a cover crop can be left growing for two years to insure hardpan penetration.

Soil Builders

From March 1981 through October 1982, the area just west of the Denver Botanic Gardens Amphitheater was planted with a variety of soil building plants. These plants were used to rebuild the soil structure in this area and to penetrate the thick hardpan layer found throughout the Gardens. Following are soil building plants which were grown with good results in Denver Botanic Gardens cover crop trial area.

Astragalus alpinus L.—Cicer Milk Vetch*

This legume has beautiful, deep green foliage with a multitude of delicate pink, pea-type blossoms from early spring until early July. It reaches a height of 18 inches the first season and 40 inches or more the second. This plant is probably best used as a one season cover crop or green manure because it becomes so tall and unsightly in its second year. It should be seeded in early April or September and turned under the following fall or spring.



Bird's-foot Trefoil

Lespedeza cuneata (Dum.-Cours.) G. Don—Bush Clover

An attractive one-season legume, bush clover should be seeded in late April and turned under the following August in order for the soil to receive maximum benefit from its lush foliage. With beautiful, bright red stems and light green foliage it attains a height of 12 inches.

Lotus corniculatus L.—Bird's-foot Trefoil*

One of the most useful and ornamental of all the plants tried, this legume has a very long, branched root system, beautiful lemon-yellow flowers and dense, medium green foliage. It blooms from May through August and is lovely when mixed with a crop of contrasting flower color. Bird's-foot trefoil gets its name from its seed pods which look like tiny birds' feet. As with most soil builders, it should be seeded in April or early fall and may be turned under either the same season or left to grow for two seasons.

Lupinus subcarnosus Hook. (*L. texensis* Hook.)—Texas Bluebonnet

Texas bluebonnet is an annual legume that makes a truly ornamental green manure. If seeded in early April, its 12-inch spikes of showy blue blossoms will decorate the yard from June to August, when it should be turned under.



Alfalfa

Medicago sativa L.—Alfalfa*

Although not especially attractive, this plant is very useful as its roots have been found to grow more than 25 feet straight down through very tough hardpans. The tops of alfalfa should be cut as least twice during the growing season to maintain a reasonable height and neat appearance. Alfalfa is best used as a one season cover crop or green manure since it persists if used for longer periods.

Trifolium fragiferum L.—Strawberry Clover*

An excellent drought tolerant plant with fragrant, pink blossoms and dense foliage, this clover should be

seeded in late March and may remain for two growing seasons. The deep root system of this legume insures good erosion control with the added bonus of nitrogen fixation for soil enrichment.

Trifolium hybridum L.—Alsike Clover

Trifolium praetense L.—Red Clover

While these legumes are not very attractive, they are useful as one season cover crops or green manures that can be incorporated at the end of the season. Alsike and red clovers can be seeded in either spring or fall. 151

Poterium sanguisorba L. (*Sanguisorba minor* Scop.)—Small Burnet

This semi-evergreen, cucumber-scented plant has lacy, dark green foliage and grows 12 inches the first season and 24 inches the second. Small burnet should be used as a one season soil builder and will perform best if seeded in April.

Vigna angularis (Willd.) Ohwi and Ohashi—Azuki Bean

Vigna radiata (L.) R. Wilcz.—Mung Bean

Vigna unguiculata (L.) Walp.—Cow Pea

Vigna unguiculata ssp. *unguiculata* (L.) R. Wilcz.—Southern Blackeye Pea

These are short season (approximately 60 days) plants; their best use is as green manures. The plants should be turned under immediately after the pods have been harvested. □

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*Drought tolerant plants.

FOCUS ON *Ficus benghalensis* in the Boettcher Memorial Conservatory

Peg Hayward

Ficus, an immense genus of about 800 species of mainly evergreen trees of diverse habit are found in tropical and subtropical parts of both hemispheres. Most famous perhaps of the Asiatic figs is *Ficus benghalensis* L., the banyan tree of India. The common name was given to this species by the British in allusion to the banians, traders of India who used the space under the spreading branches of the tree for a market place.

Banyan trees eventually reach enormous size often attaining a height of 100 feet and have the distinction of achieving the greatest spread of any tree in the world. Many banyans begin in a normal way, but some start life as epiphytes high in the branches of a host tree where the seed has been left by a bird. The seedling banyan sends down aerial roots which penetrate the ground. Gradually the

roots grow thick and strong and smother the host tree. The trunks produce spreading horizontal branches which again drop aerial roots at intervals. These roots on reaching the ground act as pillars or props to support the branches. Expanding in this way, a single tree may grow into what looks like an entire grove with hundreds of trunks and a ground coverage of an acre or more. This habit of growth is not restricted to *F. benghalensis* since many other species of *Ficus* also develop aerial roots.

Foliage of the banyan tree is a favorite fodder for Indian elephants. The dark green, ovate leaves are sparsely veined, up to 8 inches long and 5 inches wide. Flowers of the banyan, characteristic of all fig trees, are borne inside a hollow receptacle which ultimately swells and becomes the fruit. At first the fruits are green and hard, later turning red in color and soft in texture. Birds and monkeys are fond of these figs; however, humans find their taste poor.



The Banyan Tree — *Ficus benghalensis*

In India the banyan is sacred. The dangling young roots are provided with bamboo sleeves to protect them and the ground below is prepared to receive them. Because of their sacred character native workers object to cutting them and the trees are allowed to go undisturbed even though they do much damage to important forest trees and the roots destroy buildings by penetrating and eventually shattering masonry.

It is not surprising that poets have written praises of the fascinating

banyan tree from time immemorial. *F. benghalensis* may be seen in the Boettcher Memorial Conservatory collection along with others members of the *Ficus* genus. □

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Tick Talk

Wilfred Johnson

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The warmth of the spring sun fills the mountain slopes with trickles, the depressions with clear sparkling water, the streams with turbulence. Other signs of spring and summer include early insects, other arthropods, and the increasing presence of man out of doors. Among the other arthropods are ticks, which are arachnids, as are spiders and mites. There are two kinds of ticks, hard ticks and soft ticks. We are concerned here only with hard ticks.

When ticks and man occupy the same areas certain hazards present themselves, for ticks may carry diseases from the lower animals to man. In Colorado two specific "tick fevers" are transmitted by the bites of the wood tick and, to a lesser extent, by the dog tick in the north-east part of the state—Rocky Mountain spotted fever (RMSF) and Colorado tick fever (CTF). RMSF, a rather severe illness and the more severe of the two, received its name not because of great numbers of cases here but because it was first studied in this region. In reality, the greatest number of cases are reported from Maryland, Virginia and North Carolina.

Wilfred Johnson, now retired from the U.S. Public Health Service, was a long-time member of the staff of Centers for Disease Control, Atlanta, Georgia.

RMSF is caused by infection with rickettsial organisms which resemble small bacteria. Without proper treatment the fatality rate is 20 percent. With prompt treatment death is uncommon. In the state of Colorado one case was reported in 1982 and one or two in 1981, while in 1980 and 1981, 127 and 159 cases of Colorado tick fever, a viral disease, were reported.

Tick Identification

Hard ticks, in general, are about 3/16 inch long, have a flat, brownish body tapered anteriorly with what appears to be a head, actually a cluster of mouthparts, when viewed from the top (dorsally). The head, thorax and abdomen are all fused into one body region. They have no antennae and in the nymph and adult stages they have four pairs of legs. These characteristics distinguish them from the insects. Directly behind the false head of the female is a small, thickened structure called the dorsal shield. In the male it covers the entire upper surface. The female produces enormous numbers of eggs which hatch into a larval stage and progress into a nymph and adult. The adults spend much of their life on the ground on low vegetation such as tall grass, underbrush and shrubbery awaiting a host, a large mammal.

Transmission of Disease

Ticks are most numerous from April through July. Anyone who comes in contact with infected wood or dog ticks may become infected, however not all ticks are infected.

The tick must bite the person and remain embedded in the skin for two or more hours before the rickettsial organism of RMSF becomes reactivated and infection can occur. Both female and male ticks bite and suck blood, but only the female becomes greatly distended during engorgement. Infection may also result from contamination of the skin with crushed tick tissue or feces.

Tick Fever Symptoms

The symptoms of RMSF include sudden onset of chills, followed by rapidly rising fever, soreness of muscles and joints, headache, and bloodshot eyes. A rash appears on the wrists and ankles and spreads to the back, arms, legs and chest. Medical care should be sought at an

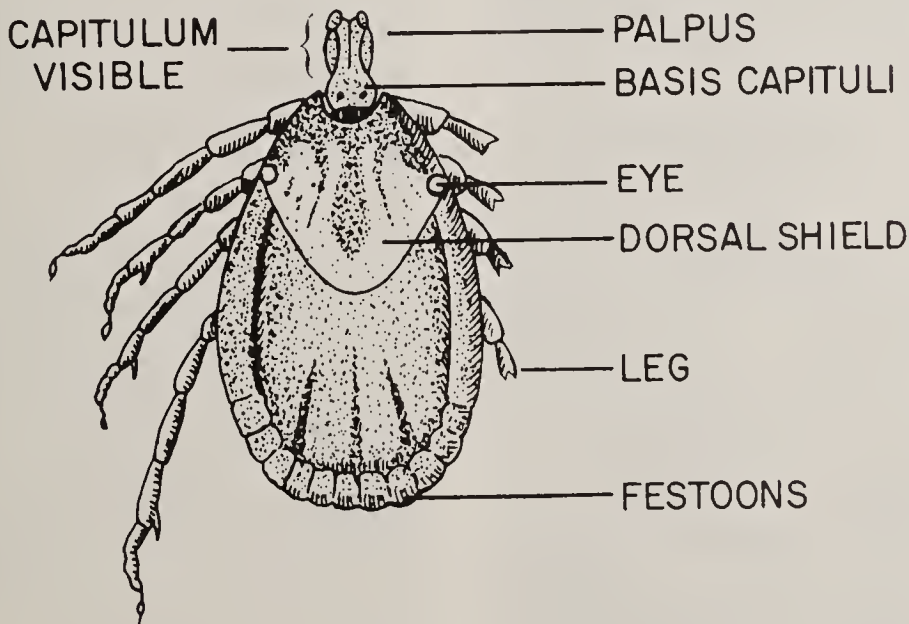
early stage. In fact, finding an embedded tick should be a signal to seek care promptly.

CTF symptoms are less acute. Aches, pains and fever lasting about three days are followed by a three to four day cessation, but then in most cases the same symptoms recur for another three days followed by recovery.

Other Diseases

Two other diseases transmitted to man by ticks and possible in Colorado deserve mentioning. One is tularemia, a plague-like disease of rabbits and rodents. This may also be transmitted to man by the bite of the deer fly or by skin contact when skinning an infected rabbit.

The other, tick bite paralysis, is produced by the engorging female hard tick and probably caused by a neurotoxic substance in the tick saliva. Its symptoms develop about six days after the tick becomes attached and while engorgement is well underway. Tick paralysis, most frequently observed in children



Female Hard Tick — Dorsal View

under seven, has a rather high fatality rate. Grown persons are rarely paralyzed. Recovery is rapid after removal of the engorging tick. The usual site of tick attachment is the scalp, particularly the back of the head.

Risk and Prevention

People who are hunting, camping, hiking in the woods, mountains, fields or who may be working on lawns or with shrubbery are especially subject to tick bites, for the ticks eagerly waiting on the low vegetation for a passing blood meal are not really too particular as to what species of large mammal will provide their next feast.

Several precautions can be taken to minimize the chance that you will provide the next meal for a hungry tick:

- Wear pants (slacks).
- Tuck trouser leg bottoms into socks or boot tops.
- Tuck shirttails into trousers.
- Button all buttons.
- Avoid sitting on the ground or on logs in brushy areas.
- Wear clothing of tightly woven material.
- Inspect clothing and body several times each day and remove any ticks before they attach. Brush ticks off or remove with a piece of paper without crushing them against your skin.
- Application of a tick repellent on boots and clothing may be helpful.

If a tick has become attached, the simplest method of removal is by a slow, steady backward pull that will not break off the mouthparts and leave them in the skin. Use tweezers if available or a piece of paper and do not squeeze so hard

the tick is crushed. There is no certain way to make a tick detach its mouthparts. A drop of chloroform, carbon tetrachloride, ether, benzene, or vaseline or fingernail polish rubbed over it will help remove the tick. It will take several minutes to one-half hour after application before the tick withdraws its mouthparts. It can then be removed with less damage to the skin. Proximity of the lighted end of a cigarette may sometimes cause it to release its attachment.

Antiseptic should always be applied to tick bite sites as with any other open wound. If the hands have touched the tick during removal they should be thoroughly washed with soap and water. It would be well to wash the site of the bite with soap and water prior to the application of the antiseptic in the event that the tick has exuded some body fluids during removal.

Immunization is available for RMSF but not for CTF and is practical only for persons at frequent, constant risk. Annual booster shots are also available.

Few cases of RMSF occur in Colorado and deaths nation-wide from treated cases are uncommon. CTF, milder but much more prevalent in the state, is considered the most common vector-borne disease affecting people in Colorado. Statistics are usually quite impersonal; but, regardless of how remote the possibility of infection, statistics may become painfully personal if you become one. Whether you visit or work in tick infested areas many times a season and for appreciable duration, or whether your exposure is infrequent and for short periods, the prudent person will be alert to the potential hazards and will take appropriate measures to minimize the risk. □

Predictions of New Wild Flowers In Colorado

William F. Jennings

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Have you ever known the thrill of discovering a rare plant—or even one not so rare to the botanical world but previously unknown to you? In the following article Jennings has postulated that three such species are likely to be found within the boundaries of our state and predicts some probable locations based upon his investigations. Perhaps, using his suggestions, you may be the one to confirm their presence within Colorado. Editor

Search for Orchids

At least 21 and probably more species of wild orchids are native to Colorado. Several more species may eventually be found in the state. Two likely candidates are *Malaxis ehrenbergii* O. Ktze. and *Malaxis macrostachya* O. Ktze. *Malaxis* orchids are small, obscure, rare orchids seldom seen by the general public, and hence they really do not have common names, although addersmouth has been applied to some species. The two species in question occur in the high, dry plateau country of Mexico, Arizona and New Mexico.

Malaxis ehrenbergii (Figure 1) is about 9 inches tall with slender spikes of very small reddish-purple flowers. The plant bears a single glossy green leaf, typical of the genus, often bending somewhat backwards. The long spike of flowers gives the plant an awkward, top-heavy look.

William Jennings, a serious botany hobbyist and photographer, is a consulting mining engineer from Boulder, Colorado.

Malaxis macrostachya (Figure 2) has the same glossy green leaf but the 6-inch flower spike is an extremely dense cluster of small green flowers held closely to the stem giving the plant an appearance similar to the lawn weed plantain.



Figure 1. *Malaxis ehrenbergii*



Figure 2. *Malaxis macrostachya*

The lip is uppermost rather than lowermost—unusual in our wild orchids.

Correll, in his classic work, *The Native Orchids of The United States*, reported that *M. ehrenbergii* had been found in Colfax County, New Mexico, which borders the Colorado state line in the vicinity of Trinidad. This is not confirmed by Luer (1975), or by Martin and Hutchins (1980) who place the northernmost station in Sandoval County in the Jemez Mountains. However, William A. Weber (personal communication) recently indicated that *M. ehrenbergii* had been reported in an environmental impact statement filed by Kaiser Steel. Kaiser has three coal mines in Colfax County, New Mexico, about ten miles south of the Colorado state line and about thirty miles west of Raton. From a historical perspective, Wooton and Standley in their *Flora of New Mexico* (1915), had only one station for the plant in all New Mexico, personally found by Wooton.

Malaxis macrostachya, also called *M. soulei* L. Williams in many manuals, has its northernmost reported station in the Jemez Mountains as well. Martin and Hutchins also report a station about as far north, in San Miguel County. Wooton and Standley were the first to report any station at all in New Mexico. Thus, the known distribution of these two orchids has been expanding over the years and moving north.

With this in mind, we decided to try to find the orchids in New Mexico, learn their habitat, and then try to find similar habitat in Colorado. On August 6, 1982, we found both these orchids in the Jemez Mountains west of Los Alamos, New Mexico, with almost ridiculous ease. Our field technique consisted of driving up State Highway 4 until likely habitat was seen. Only two spots were investigated, with an orchid found at each. Considering the ease with which they were found, we find it hard to believe that the Jemez Mountains constitute their northern limit.

Both orchids were in ponderosa pine—Douglas-fir woods. The *M. ehrenbergii* site was moist, but not wet, with several rotting logs nearby; and the plants were associated with *Goodyera repens* R. Br. and *Goodyera oblongifolia* Raf. (orchids). The *M. macrostachya* site was very dry and somewhat disturbed since it was in the campground along a trail. The most interesting plant associated with the orchids was *Monotropa hypopithys* L. (pinesap), a very strikingly red saprophytic member of the heath or pyrola family. It was this plant, noticeable from the fast-moving car, that first attracted us to the orchid areas.

Table 1
Site Specifics

Malaxis ehrenbergii O. Ktze.

Section 35, Township 19 North, Range 5 East. Los Alamos County, N.M. in the Santa Fe National Forest about 1.5 miles west of the road junction of the two branches of Highway 4 beyond Los Alamos and Bandelier National Monument (about 5 miles southwest of Los Alamos; about 8 miles northwest of the main entrance to Bandelier National Monument), on the north side of the road on a north facing slope about 500 feet off the highway. Elevation about 8,300 feet. August 6, 1982.

Malaxis macrostachya O. Ktze.

Section 3, Township 18 North, Range 3 East. Sandoval County, N.M. in the Santa Fe National Forest at Jemez Falls campground at the trailhead and along the trail to Jemez Falls (about 23 miles west of Los Alamos on Highway 4). Elevation about 7,900 feet. August 6, 1982.

In Colorado, these orchids should be looked for in the vicinity of Cumbres and La Manga Passes, in the easternmost San Juan Mountains at about 8,500 feet. This area of volcanic rock, like the Jemez Mountains, is the northern extension of the Sandoval-Los Alamos area mountains. Additionally the orchids should be looked for in the Sangre de Cristo range east of San Luis, Colorado, at the eastern edge of the San Luis Valley, and in the vicinity of the Spanish Peaks west of Trinidad, northern extension of the San Miguel County and Colfax County sites. The Spanish Peaks are old volcanic necks and could also provide soils similar to the Jemez Mountains site.

Probably the best area for the orchids would be along a county road extending south from the Las Animas County village of Stonewall about 30 miles west of Trinidad on Highway 12. This road eventually crosses into New Mexico, traversing

country between 8,000 and 10,000 feet in elevation. The higher elevations are well-forested, seldom visited, and should provide the proper habitat. Also along this road is the abandoned coal mining camp of Tercio, a CF&I company town.

We believe it reasonable to expect that other wild orchids will someday be found in Colorado. These two small, obscure species of *Malaxis* seem to be good candidates. Only time and field work will tell.

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Beargrass—a Rare Colorado Plant

Nolina microcarpa Wats.

(beargrass, sacahuista in Mexico) is a striking yucca-like plant with a large panicle of small flowers and a basal rosette of narrow, pointed leaves. Some authors place the plant in the lily family while others place *Nolina*, *Yucca*, and *Agave* in the agave family.



Figure 3: *Nolina microcarpa* in bud.



Figure 4. *Nolina microcarpa* in bloom

The common name, beargrass, is also sometimes applied to the yuccas and to *Xerophyllum tenax* (Pursh) Nutt. of the far northwest, all of which are unrelated to the grasses. Figure 3 showing the plant with flowers not fully opened was taken June 10, 1982 north of Prescott, Arizona; figure 4 showing the plant in full bloom was taken July 11, 1982 near Jerome, Arizona. The elevation is approximately 5,400 feet. The climate in this part of Arizona is mild and we thought it logical that the plant should be in Colorado as well.

Harrington (1954) states that the plant has been reported for Colorado but he found no specimens. Further, he states that the plant has been found in Oklahoma a few miles south of the Colorado state line. Martin & Hutchins (1980) show *N. microcarpa* as having been collected in Taos County, New Mexico, which borders Colorado. We decided to see if we

could track down who had first cited *N. microcarpa* for Colorado.

Sereno Watson described *N. microcarpa* in 1879 but did not list any locations in Colorado. William Trelease revised the genus *Nolina* in 1911 and in that article he describes *Nolina greenei* Wats., a species known from the collections made in southern Colorado and northeastern New Mexico. The type collection was attributed to Edward L. Greene, who had published his discovery in 1880. E. L. Greene wrote that while "clipping lichens from the rocks about Trinidad" he had discovered a plant that he thought belonged to genus *Nolina*. He apparently sent his specimen to Sereno Watson, as Greene reports the name as *N. greenei* Watson. It appears that the name was not formally published until Trelease's article in 1911. Greene goes on to say that the plant "is common up among the high rocky verges of the mesas, along with *Yucca baccata* Terr., all the way between the Apishapa River in Colorado and Las Vegas, New Mexico." Trelease (1911) reports Greene's collection to be "between the Purgatory (sic) and Apishapa Rivers, north of Trinidad, Colorado." He also reports collections in San Miguel County, New Mexico (Las Vegas is the county seat of San Miguel County), and in Lincoln County, New Mexico. Later authors reduced *N. greenei* and several other names to synonymy under *N. microcarpa*.

William A. Weber of the University of Colorado secured Greene's original specimen from the Gray Herbarium at Harvard, and verified that it was indeed *Nolina microcarpa*, and then published his observations in 1973. Dr. Weber wrote that Greene's letter to Watson was with the specimen and said the

discovery was made "in the mountains between the Purgatory (sic) and Apishapa Rivers, north of Trinidad . . . a full 30 miles north of the southern boundary line." Greene wrote further that "the plant occurs abundantly and does not hesitate to flower and mature fruit at this altitude."

In 1880 Greene would almost certainly have traveled by train. When he visited Colorado, the Santa Fe had its tracks in place from Albuquerque to Trinidad and northeasterly to La Junta, thence into Kansas via the Arkansas Valley. Today the tracks are paralleled by U.S. Highway 350. The Rio Grande ran tracks down the mountain front from Denver through Pueblo to Trinidad, later abandoning their own tracks south of Walsenburg in favor of using the Burlington Northern's parallel line built in 1895. Today's Interstate 25 closely parallels both the abandoned Rio Grande roadbed and the existing Burlington Northern tracks. Weber wrote that Greene's collection locality is probably along the Santa Fe route and that his own searches had failed to uncover the plant. However, along the Rio Grande route between Trinidad and the vicinity of the Apishapa River (today's Aguilar), is just as likely.

In a conversation with Dr. Weber, he said that there are no specimens of *Nolina microcarpa* in Colorado herbaria. However, he knew of a professor at the University of Northern Colorado (Greeley) who had found the plant in Baca County and who had transplanted it to his garden in Greeley, many years ago. Despite repeated requests, this professor was unable to remember the exact locality.

It seems strange that a plant so obvious should go unreported for nearly a century, but Dr. Weber indicated that the Trinidad area has been poorly collected. In any event, this unusual and rare (for Colorado) plant should be looked for during June in Las Animas and Baca Counties along the southeastern state boundary. □

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Perennial Flower Borders

Elaine Jackson

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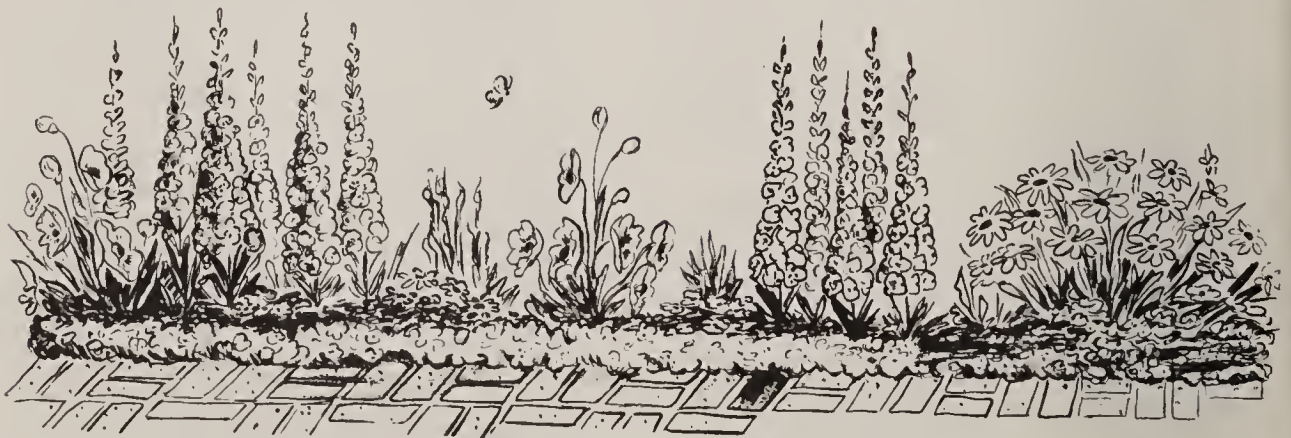
Offering a cheery greeting for visitors to Denver Botanic Gardens the perennial borders flower over an extended season and display a variety of plants hardy in our High Plains, semi-desert environment.

About 300 kinds of perennials grow along the walkway and near the entry to Boettcher Memorial Center and extend southward along Linden Alley toward Botanic Gardens House. They provide educational opportunities for home gardeners and suggest delightfully pleasing color combinations for photographers and artists as well. Bulbs, annuals, ornamental grasses

Elaine Jackson, a Trustee and active volunteer at Denver Botanic Gardens, recently received the Zone XI Horticultural Award presented by the Garden Club of America for horticultural excellence.

and low shrubs were planted among the perennials to lengthen Colorado's relatively short growing season of approximately 150 days. Here average killing frost dates are May 10 and October 5.

Color, mood and tempo change with the seasons: bright greens and soft greys of young shoots forecast springtime's coming to the Rockies with hundreds of gaily colored bulbs heralding the season. Later peonies, gas plants, bleeding hearts and poppies mingle with towering foxtail lilies, ornamental onions and stately spires of delphinium, foxglove, penstemon and veronica. Highlighting the summer borders are old-fashioned pincushion and balloon flowers, irises, daylilies, columbines and more. Rich burgundies, golds and bronzes



climax the year in sedums, chrysanthemums, heleniums and other favorites further enhanced with brilliant autumnal foliage.

For many years immense plantings of annuals greeted visitors to Denver Botanic Gardens but these spring plantings far exceeded energies of staff and volunteer gardeners combined. Finally, a small group of volunteers, members of Around the Seasons Club, donated funds to establish a perennial cutting garden in order to obtain plant materials needed for craft projects and for drying. A horticultural committee drafted a list of plants and scale design for two beds 70 feet long and 10 feet wide bordering the walkway. Flowers, seed pods and foliage were chosen to fulfill specific needs for the

Gardens—demonstration classes in horiculture, fresh flower arranging and design of winter bouquets.

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Vast quantities of humus (compost and peatmoss) were incorporated to condition the clay soil predominant in our area. Tile drains were installed and the first spring bulbs and peonies were planted in September 1978 with plantings of most perennials the next April and May. Maintenance is a cooperative effort of many volunteers and staff gardeners.

The select list of perennials chosen for planting should prove helpful for novice and experienced gardeners in planning or revising their perennial gardens. Those marked with * indicate shade lovers.



Selected List of Perennials

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Proper Name	Common Name	Color	Height (Ft.)	Month of Bloom
<i>Achillea</i>	Yarrow	Yellow	3-4	July-Aug.
<i>Aconitum</i>	Monkshood	Purple	4-5	June-Sept.
<i>Ajuga</i>	Bugle	Red/Blue	½	July-Sept.
<i>Althaea</i>	Hollyhock	Various	4-8	June-Sept.
<i>Alyssum</i>	Basket of Gold	Yellow	1	April-May
<i>Anchusa</i>	Alkanet	Blue	2-4	June-July
<i>Anemone</i>	Windflower	White/Pink	3-4	Aug.-Sept.
* <i>Aquilegia</i>	Columbine	Various	2-4	June-Aug.
<i>Artemisia</i>	Sage Brush	Grey Foliage	1-3	May-Sept.
<i>Aster</i>	Michaelmas Daisy	Various	1-5	Aug.-Sept.
* <i>Astilbe</i>	False Spiraea	Red/Pink	1-3	July-Aug.
<i>Baptisia</i>	False Indigo	Blue	3-4	Aug.-Sept.
* <i>Bergenia</i>	Megasea	Pink	1	May-June
<i>Chrysanthemum</i>				
<i>C. coccineum</i>	Painted Daisy	Various	2-3	June-July
<i>C. maximum</i>	Shasta Daisy	White	1-3	June-Sept.
<i>C. morifolium</i>	Hardy Chrysanthemum	Various	1-2	Sept.-Oct.
<i>Coreopsis</i>	Tickseed	Yellow	1-3	June-Aug.
<i>Delphinium</i>	Larkspur	White/Blue	3-6	June-July
<i>Dianthus</i>	Garden Pinks	White/Red	1	June-July
* <i>Dicentra</i>	Bleeding Heart	Pink & White	3-4	May-June
<i>Dictamnus</i>	Gas Plant	White or Pink	2-3	June-July
<i>Digitalis</i>	Foxglove	White/Red	2-5	June-Aug.
<i>Doronicum</i>	Leopardsbane	Yellow	1-2	May-June
<i>Echinops</i>	Globe Thistle	Blue	3-4	July-Aug.
<i>Erigeron</i>	Fleabane	Lavender	1-2	July-Aug.
<i>Eryngium</i>	Sea Thistle	Blue	1-3	July-Aug.
<i>Gaillardia</i>	Blanket Flower	Red & Yellow	1-4	June-Aug.
<i>Geum</i>	Avens	Red or Yellow	1-3	June-July
<i>Gypsophila</i>	Baby's Breath	White	3-4	July-Aug.
<i>Helenium</i>	Sneezeweed	Yellow/Bronze	3-4	Aug.-Sept.
<i>Heliopsis</i>	Sun Flower	Yellow	3-4	Aug.-Sept.
<i>Hemerocallis</i>	Day Lilies	Yellow/Red	1-3	June-July
<i>Heuchera</i>	Coral Bells	Pink/Red	2-3	July-Aug.
* <i>Hosta</i>	Plantain Lily	Various Foliage	2-3	June-Sept.
<i>Iberis</i>	Candytuft	White	1	May-June
<i>Iris</i>	Bearded Types	Various	1-4	May-June
<i>Iris</i>	Spuria Types	Various	3-5	June-July
<i>Kniphofia</i>	Red Hot Poker	Yellow & Red	3-4	July-Aug.
<i>Liatris</i>	Gay Feathers	White or Coral	3-5	July-Aug.
<i>Limonium</i>	Sea Lavender	Blue & White	1-2	July-Aug.
<i>Linum</i>	Blue Flax	Blue	1-2	June-Aug.
<i>Lupinus</i>	Lupine	Various	2-5	June-Aug.
<i>Lychnis</i>	Maltese Cross	Scarlet	3-4	July-Aug.
<i>Monarda</i>	Bee Balm	White/Red	3-4	June-July
<i>Oenothera</i>	Evening Primrose	Yellow	1-3	June-Aug.
<i>Paeonia</i>	Peony	White/Red	2-3	May-June
<i>Papaver</i>	Oriental Poppy	White/Red	2-3	May-June
<i>Penstemon</i>	Beard Tongue	Blue & Red	1-3	June-July
<i>Phlox</i>				
<i>P. paniculata</i>	Hardy Phlox	Various	2-4	July-Aug.
<i>P. subulata</i>	Moss Pink	Various	1	April-June
<i>Physostegia</i>	False Dragonhead	White or Pink	2-4	June-Aug.
<i>Platycodon</i>	Balloon Flower	White or Blue	2-3	June-July
<i>Rudbeckia</i>	Cone Flower	Yellow	3-6	July-Aug.
<i>Scabiosa</i>	Pin-cushion	Blue	2-3	June-Aug.
<i>Sedum</i>	Stonecrop	Pink	1-2	Aug.-Sept.
<i>Tradescantia</i>	Spiderwort	Blue	1-2	June-Aug.
* <i>Trollius</i>	Globe Flower	Yellow	1-2	June-Aug.
<i>Veronica</i>	Speedwell	Various	1-5	June-Aug.

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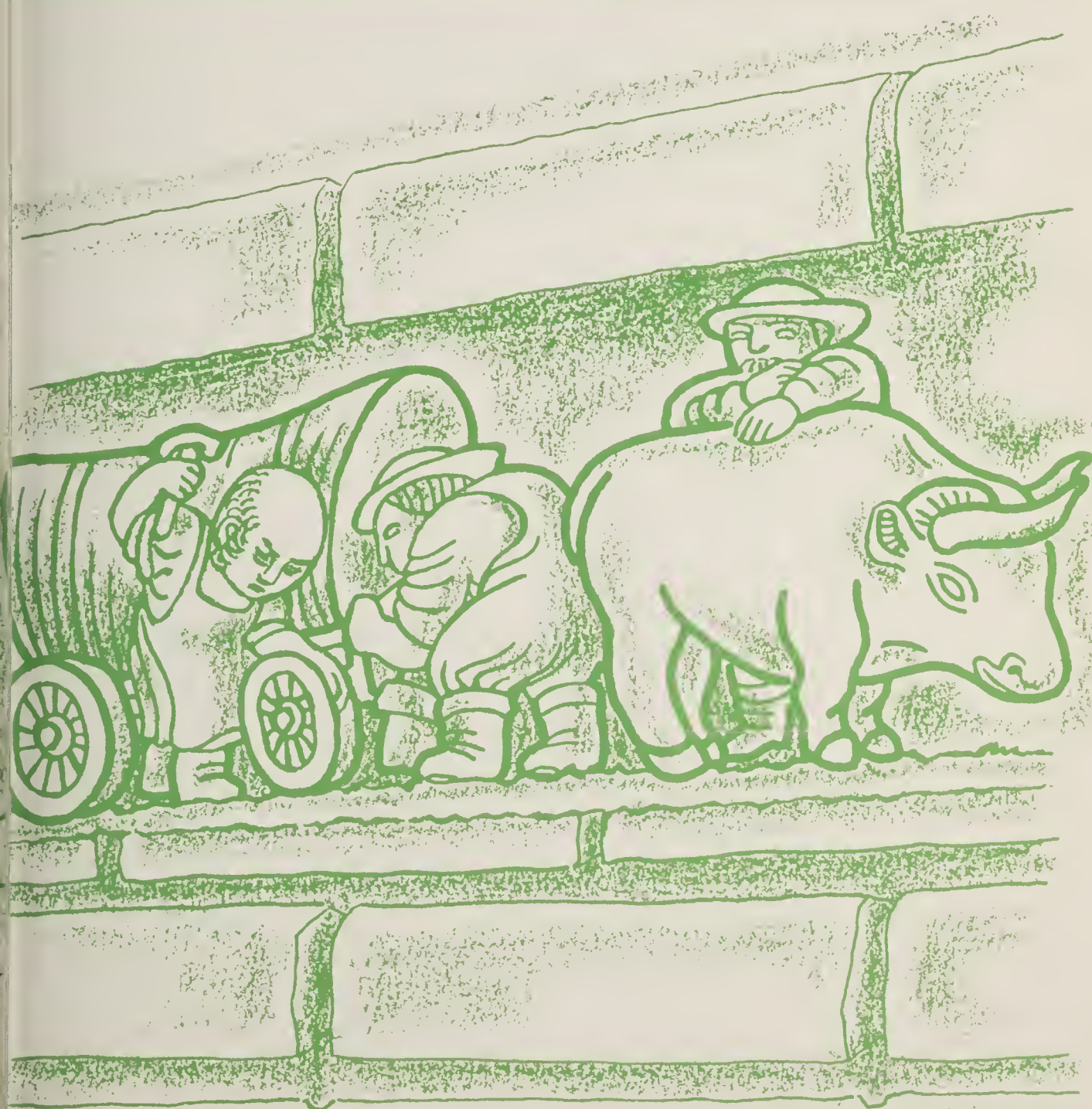
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The Cover

Garrison Frieze

Frances Frakes Hansen

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Velma A. Richards
Editor

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Denver Botanic Gardens, Inc., maintains a collection of living plants, both native and exotic, for the purpose of acquiring, advancing, and spreading botanical and horticultural knowledge.

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The Plains Garden at Denver Botanic Gardens

Gayle Weinstein

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We identify with some of our country's landscapes whether mountains, prairies, or plateaus. We observe them, study, describe, recreate and share them. The mountains and plateaus are glorified—the prairies are often least appreciated and least understood. It is through this scenery that motorists travel at night and risk speeding by day.

By contrast, the high relief of the mountains makes the plains appear smooth and flat. A paradox! In this seemingly innocent contour, some of nature's most dramatic vagaries occur. It is an area that forces upon its inhabitants a respect for natural conditions.

Generally, the prairie is the inner continental belt that lies between the eastern forests and the Rocky Mountains. This grass-dominated interior owes its origin to deposits of sand or clay soils laid down after the last glaciation and has developed where mountain masses separate the interior from oceans and moisture-laden prevailing winds. This separation is a contributing factor to the

deficiencies in rainfall, one of the most influential phenomena in preventing grasslands from developing into forests.

Precipitation and water holding capacities of the soils influence the boundaries and species of grasses. The eastern portion of the belt consists of tall grasses, the western portion short grasses; and in between is a mixed community. This floristic continuum fluctuates as precipitation varies.

Of the interior prairie belt, the Great plains is a physiographic province east of the Rocky Mountains. As a result of mountainous uplifts, alluvial deposits and erosive outwashes have created its present surface features. The Great Plains encompasses much of western Texas, parts of Oklahoma, Kansas, Nebraska, Colorado, and the Dakotas. Local differences in geology, geography, and land forms further divide the Great Plains into eight classifications: The Black Hills, Colorado Piedmont, High Plains, Plains Border, Glaciated Missouri Plateau, Unglaciated Missouri Plateau, Edwards Plateau, Raton, Pecos Valley, and Central Texas.

The High Plains, Colorado Piedmont and Plains Border comprise the central and parts of the southern plains. These divisions have been

Gayle Weinstein, botanist-horticulturist in charge of the York Street outdoor gardens of Denver Botanic Gardens, is working with a committee of volunteers and staff in designing the Plains Garden.

singled out because they are sections which have served as role models in the organization and development of the Plains Garden at Denver Botanic Gardens.

The objectives of the Plains Garden are to:

- Selectively represent the landscape characteristics and plant species of the High Plains, Colorado Piedmont, and Plains Border sections of the Great Plains.

- Create an area of aesthetic value.

- Create an awareness of the variety of features present in the selected sections of the Great Plains.

- Show natural associations of plant species as they are found in the High Plains, Colorado Piedmont, and Plains Border.

- Provide a site in which the particular species or taxonomic

groups found in these selected regions can be studied.

- Represent yet another plant life zone of Colorado in conjunction with the already existing Rock Alpine and Montane Gardens of Denver Botanic Gardens.

There is inherent difficulty in trying to replicate, in its entirety, the Great Plains in an area of less than an acre. Any attempts to do this would, at best, be incomplete.

Recognizing this, various types of vegetation as well as landforms have been selected to typify the High Plains, Colorado Piedmont and Plains Border regions of the Great Plains.

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Vegetation

The vegetation of the selected regions consists not only of grasslands, but also of forbs, shrubs, woodlands, and forests. Although the Great Plains is often considered a short grass prairie, there are areas in which the tall and mid



The Great Plains Province and its Sections

grasses exist. The tall grass communities are normally restricted to the eastern part of the North American prairie belt. However, in locations such as the sand hills of eastern Colorado and Nebraska they are dominant. These tall grasses were at one time more widely distributed, but due to climatic changes and overgrazing, they have become more restricted in their ranges. In the semi-arid areas, they are found in sandy soils. They are deep-rooted grasses and, because sandy soils allow for deeper infiltration of moisture, they can survive.

A sampling of the species in the grass communities are:

- Short grass prairie: *Bouteloua gracilis* (H.B.K.) Lag. (Blue Grama), *Buchloe dactyloides* (Nutt.) Engelm. (Buffalograss), *Sphaeralcea coccinea* (Pursh) Rydb. (Cowboy's Delight), *Psoralea tenuiflora* Pursh (Indian Breadroot).

- Mid grass prairie: *Stipa comata*, Trin. & Rupr. (Needle and Thread), *Agropyron smithii* Rydb. (Western Wheatgrass), *Liatris punctata* Hook. (Gayfeather), *Eustoma grandiflorum* (Raf.) Shinnery (Tulip Gentian).

- Tall grass prairie: *Andropogon gerardii* Vitm. (Big Bluestem), *Panicum virgatum* L. (Switchgrass), *Ratibida columnifera* (Nutt.) Woot. & Standl. (Cone Flower), *Dalea purpurea* Vent. (Prairie Clover).

Among the grasslands and forbs, are scatterings of woody plants. Shrublands of *Ribes cereum* Dougl. (Wax Currant), *Rhus trilobata* Nutt. (Threeleaf Sumac) and *Prunus virginiana* L. (Chokecherry) are found near topographic breaks or in transition areas. *Symphoricarpos orbiculatus* Gray (Coralberry) and

Rosa woodsii Lindl. (Wood Rose) are found along river bottoms. Woodlands and wetlands on the plains create a dramatic change and occur where modifications in elevation or soil texture create environments suitable for such forests and shrublands. Other types of woodlands are the so-called pygmy forests or xeric woodlands. They are comprised of low, needleleaf evergreen trees with varying mixtures of shrubs and herbaceous plants, e.g. *Juniperus monosperma* Engelm. (Singleseed Juniper) and *Pinus edulis* Engelm. (Pinyon Pine).

Forests that occur along the flood plain consist primarily of *Populus* (Cottonwood) and *Salix* (Willows) species. The success of these species is due to their ability to germinate during periodic flooding.

Topography

Contours and landforms play an important role in creating environments that will accommodate a variety of plant growth. In addition, they enhance a dimension that otherwise appears ordinary.

Sharp breaks in topography such as outcrops provide areas where greater moisture accumulates. There is deeper infiltration and greater concentration due to run off. Shrubs and tall grasses often find their niche among these sites.

Slopes and undulations are less obvious in the grasslands, but nevertheless play a significant role in species locations. The tops of slopes are usually drier than the lower areas; therefore, warm season grasses tend to dominate the crests, and cool season grasses, the bases. Arroyos often support different species in their interior than are found in the immediate surroundings.



The Plains Garden site with sandstone outcrops and arroyo.

In addition to selecting various types of vegetation as well as topographic features to represent the plains, it was also felt that a small area should be set aside for a pioneer garden.

As pioneers settled the Great Plains, many brought seeds with them and found comfort in traditional things: poppies, hollyhocks, peonies, roses, pinks, etc. The preference for passing on tradition through the generations, the isolation of domesticated space in a wilderness, and the awareness of our heritage and influence on the environment are symbolically stated in the Pioneer Garden.

In its entirety, the Plains Garden is a grass dominated landscape designed to draw attention to the complexity and beauty of the Great Plains. The special features of the Plains Garden at Denver Botanic Gardens are the xeric woodlands, riparian woodlands, sandhills vegetation, shrublands, grasslands, wetlands, arroyo, sandstone outcrop, and pioneer garden.

The funds were provided by Mrs. James S. Waring in memory of her mother, Mrs. Laura Smith Porter. The Laura Porter Plains Garden will not only serve in her memory but as a record of our heritage as well. □

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Laura Smith Porter: Pioneer

Josephine Robertson

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What sort of person was Laura Smith Porter, who came as a child in a covered wagon to "Denver City" and for whom the new Plains Garden is named? Looking back over a vista of ninety years, Mrs. Ruth Porter Waring sees her as "Mother," a strong, quiet woman whose life centered on her husband, Henry M. Porter, and her children for whom she created a happy home. Ruth was the youngest of the five children.

Laura Smith must have been an attractive child. According to family tradition an Indian chief wanted to buy her because of her beautiful long hair. Another tradition holds that Henry M. Porter, a brilliant young business man, met her as a young girl, thirteen years his junior, and declared he would wait for her to grow up and then marry her. This he did when she was twenty-one.

Both Laura's father and husband came from hard-working families in Pennsylvania, and foresaw success in the West, not in mines but in furnishing needed services and supplies to the growing population. They both became wealthy men.

Laura's father, John W. Smith, left his home in the late 1850s with a wagon train of supplies, headed for Leavenworth, Kansas, and set up a store which he ran successfully for two years. In 1860 he arrived in Denver with his wife and five children. This time his wagon train contained provisions, a melodeon and, more important, mill machinery.

He set up a quartz mill in Left Hand Canyon, Boulder, then others elsewhere. He also established the first flour and corn mills and the first cracker factory in the state. With the profits from the mills he set out to fill another need—a good hotel. The three story American House, located at Blake and 16th Street, was the most luxurious in the state for ten years. These were years when guests had to arrive by stage, wagon or horseback. The American had a large ballroom, the scene of many social gatherings. Well known men of the day were frequent guests. They included Governor McCook, Colonel Sheridan, Cyrus Field and General Custer. The peak of its social history came with a great ball given in honor of the towering Grand Duke of Russia who had come west for a buffalo hunt.

John Smith was instrumental in founding the Colorado Savings

Josephine Robertson, a member of the Editorial Committee of Denver Botanic Gardens, is a free lance writer with a special interest in history relating to gardens.



Bank. Like many of his contemporaries he held some mining interests. He donated a part of the land for the State Capitol (as did Henry Porter), and built the Smith Ditch which brought clear, rushing water into a barren city. The many laterals made gardening and tree planting possible.

Henry M. Porter left Pennsylvania to work on telegraph lines. During the Civil War he was recruited by the government to run lines along the Mississippi and elsewhere, a great help to the Union Army. He arrived in Denver in 1862 and established a wholesale grocery with a longtime friend. Soon he was in the commission business: he organized Boettcher and Porter (now Boettcher and Company), as well as banking houses in several other communities. He had extensive land and cattle interests in New Mexico, was president of the US and Mexico Telegraph Company

and promoted the Denver Pacific Railway—to name only a few of his activities. He is remembered in Denver by the institution bearing his name, Porter Hospital. He gave land and money for the building to the Seventh Day Adventists who, in a California hospital, once saved his life. A man of incredible vigor, he lived to the age of ninety-nine.

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The most intimate glimpse we have of his marriage comes from a privately printed little book, written in his later years, entitled *My Autobiography*. It is divided into short sections telling of adventures with the Indians, high finance and far-sighted ventures. One section has the heading "Getting Married to Laura W. Smith." It begins

"After [I had been] living in Elizabethtown and Cimarron, [New Mexico] for two years, Laura W. Smith and I were married at her home early in the morning of Feb. 23rd, 1874, by the Reverend B.T. Vincent. We left on an early train to Kirksville, Missouri, and visited my folks for a few days, on to Chicago, up to Michigan; thence to Niagara Falls, Boston and New York... to Philadelphia, Pittsburgh, St. Louis and Kansas City and home to Cimarron where we lived at a hotel kept by the McCulloughs and where Dora G. Porter was born, Dec. 30, 1874.

"My wife and I frequently drove our carriage to the end of the D. & R. G. Railroad and took the train to Denver to visit her family.

"We fitted up a home at the end of our store by adding four rooms to three large ones formerly used for an Indian Agency. The country was full of Indians: some two thousand of them drew rations each week in town."

In the next five years two sons were born.

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"We now had a very interesting family and were never happier than at this time. . . . We had a few choice friends who were to us like kinfolks. . . .

"All men and women at an early period of life desire a mate. A young man is never more contented than when he is working and planning a home and comforts for a loving wife and children. . . . A woman is never more contented than in her natural element when she is busy with her household affairs, raising a family of loving children and devoting her attention to the wants of husband and children. Under these conditions they have but small time or inclination to pry into the affairs of others."

In spite of this husbandly comment of a century ago, his daughter remembers that he had high regard for her mother's opinions and often commented that she was a keen judge of character.

After they returned to Denver, Ruth, their youngest child, was born in their home on Colfax and Sherman. She has happy memories of the place with its horses, cow, and kittens in the hayloft. Later the Porters built a large house at 975 Grant Street. It was a lively place where the boys often rounded up their friends with assorted instruments for musical sessions in the small ballroom.

While we would like to know more about this strong woman who lived for ninety-eight years, we are sure that her life was full and interesting, both in the home of her pioneer father, and in her own home with an adventurous husband who was in the vortex of affairs in young Denver and whose interests spanned the West.

The Porters loved to travel. In 1912, just after the Titanic disaster, they sailed, with their two daughters, on the Rotterdam, engaged a limousine and toured Europe for three months.

What a contrast to their early years!

Both Laura and Henry Porter had come to Denver by lumbering covered wagon, always with a sharp lookout for hostile Indians. While Laura's father and husband had both become wealthy and important citizens of the newly settled state, she knew, at first hand, the frontier experience. The Plains Garden, which will bear her name is an appropriate tribute, not only to Mrs. Waring's mother, Laura Smith Porter, but to the other women of the past century who helped their husbands turn an ugly, rough settlement into a tree shaded center of business and culture. □

John W. Smith 1815-1895
Henry M. Porter 1838-1937
Laura Smith Porter 1853-1951

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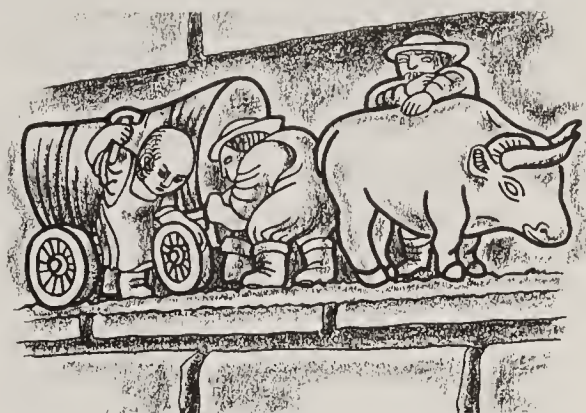
The Covered Wagon Frieze—A Robert Garrison Creation

Julia Andrews-Jones

There are pioneers with their covered wagons in Denver Botanic Gardens. Those visitors who view the grounds from the west gate near Cheesman Park see one of Denver's treasures on the west face of the wall at the Plains Garden.

Inset in the beige "adobe" wall is the Covered Wagon Frieze, a series of terra cotta plaques 11½ inches high. Actually the bricks are concrete, formed to represent the adobe bricks with their rounded sides often found in Spanish-style buildings of the Southwest.

Julia Andrews-Jones, a practicing member of the American Society of Landscape Architects, was a member of Denver Botanic Gardens Editorial Committee in the early 1960s. After several years in Africa, she returned to the committee in 1974. She has long been a devotee of Garrison's sculptures.



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The name, "Covered Wagon Frieze," used by Alan Fisher to reference the frieze, was also used in the City Club of Denver publication, *Art in Denver*, January 1928. The "Story of a Pikes Peaker" was the title used in the publication, *Denver*, August 12, 1926.

The plaques were sculpted by Robert Garrison in 1926 as part of architectural decoration for the new Midland Savings Building on Seventeenth Street at Glenarm Place. The resolute little figures sturdily marching westward were forgotten in the intervening years by a Denver that could not see them in detail in their location 20 feet above the sidewalk.



To appreciate the underlying humor of the sculptor, the viewer must remember the tiles were an integral part of the Romanesque style of the bank building. The press accounts about the opening of this building lauded the architects, W.E. and A.A. Fisher, for choosing a Romanesque style of architecture, a style often found in churches of Europe built 1000-1300 A.D. and characterized by extensive use of ornamentation on the capitals and twisted columns. This was an original choice of style over the more classical styles for a financial institution. Inherent in the Romanesque style are a particular form of arches and moldings and the richness of the decoration. This is apparent particularly in the way the folds of the clothing are sculpted; and the tunic shirts of the men give them a medieval character.

In 1964 the facade of the first two floors was remodeled to reflect a contemporary, forward-looking institution. Consequently, the building lost its tight, integrated design. The twisted columns, the striping in the brick work, the molding of the archways, and the particularly fine form of the machinery housing at the top of the building now seem out of character.

The windows of the second floor of the Midland building and the main doorway interrupted the continuous march of the characters in the frieze in its original location several feet below the cornice over the main arch. A different order of the plaques is published in *Denver* August 12, 1926 from that published in *The Echo* of August 4, 1926; but the story they tell is the same.

“In 1860 a Mississippi river farmer hears of the opportunities in the Far West. With his family he joins a wagon-train bound for the Rockies. Indians on the great American Desert fiercely attack the pioneers. The Pikes Peakers desperately defend themselves. Rushing to the rescue, the U.S. cavalry defeat the redskins. The pioneers tend their wounded. In solemn grief they bury their dead. With ‘Pikes Peak or Bust’ as their slogan, they again take up the long march, determined to conquer all obstacles. Their supplies short, they kill the black buffalo for meat. They first see the mountains. At a small trading-post, Denver, they outfit to search for gold. They discover gold. And then they establish industry and commerce.”
(*Denver*, August 12, 1926)



Some tiles were too damaged when they were removed from the Midland Savings building to mount in the wall at the Gardens. The noticeably angled tile is not broken; it was made that way because it abutted the front doorway arch. Although not in the original order, the tiles are now mounted in one continuous strip instead of in groups. This explains why some tiles flow from one to another, and some do not.

Another example in Denver of the integrated architecture and sculpture that is characteristic of the Romanesque style is South High School, another Fisher and Fisher building with sculpture by Robert Garrison. Again, the art critics were more appreciative of Robert Garrison's talent for integrated architectural decoration than was the general public because the meld was so well done. The clock tower with the hours as figures of the zodiac and the joyous, charming terra cotta tiles would stand alone in their originality, but are so important to the whole design.

Other sculptures of Garrison that adorn our city are: the bronze mountain lions at rest on each side of the doors of the state office

building on Colfax Avenue and Sherman Street; the bronze seals and children happily playing in the Voorhies Memorial pool in Civic Center; the profound orthodox symbolism on the B'nai Brith unit at National Jewish Hospital; the massive boy and girl athletes that stood in special niches on the Denver University stadium facade before it was torn down; and the Minerva in the main auditorium at Morey Junior High School. If you look closely, you will see that his classical Minerva has a 1920s hair style, another example of his feel for the contemporary.

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On May 30, 1895 in Fort Dodge, Iowa, Garrison was born to Mr. and Mrs. Alfred Garrison. After high school he attended the Pennsylvania Academy of Fine Arts in Philadelphia. He studied sculpture with Adab Robinson and the Borglum brothers, Solon and Gutzon. After serving in the 218th field signal corps in World War I, he arrived in Colorado on vacation. He stayed to work as a guide in Rocky Mountain National Park. In Estes Park he fell in love with Colorado and with Katherine Cranmer whom he married. He remained in Denver where he had a





The Midland Savings Building, with the Garrison frieze and other Romanesque decoration as it appeared in 1926.

large teaching studio and was very active professionally during the 1920s.

Garrison left Denver in 1927 to work in New York. There he completed "Pegasus" at Rockefeller Center, commissions on the Riverside Church, fountains at Kings County Hospital, and a heroic figure at West Point.

After Pearl Harbor he enlisted in the Army and was assigned to the staff school at Poughkeepsie, New York. While teaching camouflage there he was the victim of an accident which took his life on November 1, 1943.

The Covered Wagon Frieze is now at eye level in the Plains Garden where it tells its story of the hardships of the pioneers emigrating west. Why do the men's shirts look like Martin Luther's rather than Daniel Boone's? Remember, these little pioneers once marched across the facade of a Romanesque style building.

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The Time of the Water Lilies

Joseph V. Tomocik

Each year from early July through mid-September, Denver Botanic Gardens hosts a dazzling performance, never failing to captivate and enthrall an audience of casual observers and dedicated gardeners. Photographers and artists alike attempt to capture the magic of a truly remarkable plant—it is the “time of the water-lily.”

Water lilies (*Nymphaea*) are divided into several major groups including hardy water lilies (sub-genus *Castalia*), tropical night-blooming water lilies (sub-genus *Lotos*), and tropical day-blooming water lilies (sub-genus *Brachyceras*). Most varieties available today are the result of painstaking work by hybridizers such as Bory Latour-Marliac of France (hardies) and George Pring of Missouri Botanical Gardens (tropicals).

One might suppose that a plant possessing so many admirable qualities would be difficult to grow. Amazingly, just the opposite is true. The amount of time and effort required to maintain water lilies is small compared with the bountiful beauty received. Water lilies seem to do exceptionally well in Denver for they thrive on plenty of sunshine; and Colorado provides just that, with an average of 72.5 percent of possible sunshine for June - September, in contrast to 63-75 percent for Cleveland, Ohio, and 62 percent for Baltimore, Maryland.

Cultivation of Water Lilies

In Colorado hardy water lilies are treated as perennials and tropical water lilies as annuals. Although tropicals require more careful treatment than the hardies, this is compensated for by the spectacular blooms on stout stems reaching 12 inches or more above the water level. Too, they are more heavily scented and bloom well into September, when the hardies are entering dormancy.

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Our cool night temperatures dictate a somewhat delayed planting schedule for water lilies in this area compared with eastern and mid-western regions. Late May for hardies and mid-June for tropicals are suggested planting times here. Resist the temptation to plant tropicals earlier, as a sudden cold spell could send them into dormancy from which they might not recover. Tropicals should not be set out when water temperatures fall below 70 degrees.

Polyethylene containers measuring 15 inches in diameter by 9 inches deep are suitable for most hardies, while containers 19 inches in diameter by 9 inches deep are better suited for tropicals. Larger containers, however, will often allow for healthier plants with more blooms. The preferred growing medium for water lilies is a mix of three parts topsoil and one part well-rotted cow manure. Young plants should be set with crowns extending about 1 inch above the soil line. A 1-inch layer of sand or

Joseph Tomocik, a graduate of Youngstown University, Ohio, is responsible for the water gardens at Denver Botanic Gardens and has taught a class in water lily culture.



Water lily display at Denver Botanic Gardens

gravel spread over the soil will prevent muddying of the water. From 6 - 12 inches of water should cover the tops of the containers. As the leaves of the tropicals are extremely tender, the plants should not be exposed to direct sunlight when not in the water.

Since water lilies are known to be heavy feeders, water-garden specialists have developed their own "tablet-form" fertilizers, and suggest that plants be fed once a month during the growing season. Again, water lilies thrive on sun—the more the better.

Tropicals are usually discarded after the growing season, although they can be overwintered in greenhouse situations. Hardies can be left in pools or removed to cool, protected areas for the winter. It is important that the roots should not freeze and that the soil should be kept moist. In spring, hardies can be propagated simply by breaking off and repotting the newly formed

tubers. Through such dividing, the Gardens' water lily inventory has increased seven-fold over a two year period.

Water Lily Elites

Each water lily is characterized by a unique beauty of its own and picking the best is no easy accomplishment. However, some varieties seem to command more interest than others. Seven of these elites, all growing at Denver Botanic Gardens, are:

Hardy Water Lily 'Rose Arey': A deep salmon selection and the most fragrant hardy.

Hardy Water Lily 'James Brydon': A highly prized, deep rose-red variety.

Hardy Water Lily 'Chromatella': A prolific, canary-yellow bloomer. On August 3, 1982, 20 6-inch blooms were counted on a single plant in the Gardens' pool.

Day-Blooming Tropical Water Lily 'Director Moore': Stately, light blue, 9-inch flowers and 22-inch, dark green leaves with maroon edges; named for the director of Missouri Botanical Gardens in St. Louis.

Day-Blooming Tropical Water Lily 'Evelyn Randig': An especially fragrant selection with lovely green and purple variegated leaves and warm magenta-rose flowers.

Day-Blooming Tropical Water Lily 'Afterglow': Changeable 8-inch blooms in shades of pink, orange and yellow.

Night-Blooming Tropical Water Lily 'Mrs. John A. Wood': Six exquisite pink flowers, closing at about noon, were spotted early on the morning of September 3 on this variety with its eye-catching, 18-inch diameter, maroon leaves.

Additions this summer will include 'Dauben,' a viviparous tropical water lily in which practically every leaf develops a new plant; 'Green Smoke,' a sensational day-blooming tropical water lily in an unusual color, and several dwarf water lilies displayed in half barrels.



Tropical water lily



Hardy water lily

This summer another glorious spectacle of floral royalty will once again unfold from early July through mid-September for it is the "time of the water lily." □

Sources of Water Lilies

Slocum Water Gardens
1101 Cypress Gardens Rd.
Winter Haven, FL 33880

Specimen Plants
5483 S. Prince
Littleton, CO 80120

Van Ness Water Gardens
2460 North Euclid
Upland, CA 91786

Walter's Aquatic Plants
6073 Lancaster Drive
San Diego, CA 92120

William Tricker, Inc.
7125 Tanglewood Dr.
Box 7843
Independence, OH 44131

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Art and Artists

The Green Thumb—

Janet Wingate

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Fascinated with wildflowers, trained as a botanist, and skilled as an illustrator, Janet L. Wingate has been a valuable contributor to the publications of Denver Botanic Gardens during the past decade.

Alpine Wildflowers of Mt. Goliath, Janet's most recent work, reflects these interests and talents; for in this attractively designed guide she has concisely described and carefully drawn 58 wildflowers commonly found above timberline throughout the Rocky Mountains.

Art was a part of her growing-up years. Basically self-taught, Janet works with pen and ink and is also interested in watercolors and bronze sculpture. She is keenly perceptive and acutely aware of each minute detail whether examining and illustrating flowers in the field or under a dissecting microscope.

Professionally she is a botanist; a graduate of Kansas State University, her M.S. and Ph.D. degrees are from the University of Oklahoma with emphasis in taxonomy and morphology. She has taught at Kansas State University, the University of Denver, Metropolitan State College and Denver Botanic Gardens. Presently she is conducting an inventory of the vascular plants of the Chatfield Arboretum site as well as verifying the Gardens' living collections,

preparing herbarium voucher specimens as a permanent record of the plants cultivated at the Gardens. Besides her work as a volunteer and part-time staff at the Kathryn Kalmbach Herbarium she is a museum associate of the Herbarium, University of Colorado at Boulder.

Children from 8 to 88 found her riddles, puzzles, facts and fanciful figures stimulated a curiosity about plants indoors and out, native or exotic, during her 5 years as editor of the *Jolly Green Gardener*, our bi-monthly publication for juniors. Besides contributing many articles and illustrations for *The Green Thumb* magazine and *Newsletter* over the years, all too briefly in 1975-76, she and her husband Dr. Hugh Wingate, also a botanist, shared their expertise and talents by editing the magazine.



Alpine Spring Beauty



Actineae



Alpine Primrose



One-headed Daisy

Janet has produced dozens of drawings for our children's garden handbook, *Index Seminum*, and the *Tropics to Tundra* brochure.

Whether volunteer or professional, primarily she is interested in combining her knowledge as a botanist with her skills as an illustrator to help others learn to identify the plants around them. With *Alpine Wildflowers of Mt. Goliath* she succeeds admirably.

According to Janet: "Wildflowers growing above timberline hold a special fascination for both professional and amateur naturalists. This high altitude flora is subjected to harsh winds and subfreezing temperatures throughout much of the year, comparable to the conditions in the Arctic. The growing season is short, lasting from less than 6 weeks to about 12 weeks. The survivors of this endurance test tend to be tiny perennials which produce a veritable blanket of colorful flowers during times of optimum growth conditions."

In this simplified guide to alpine wildflowers Janet has divided them into four groups by flower color. Plants are illustrated and identified

by common name, scientific name and plant family. She has noted key characteristics including flower type (structure) and range of height.

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Mt. Goliath, a lesser peak of the Mt. Evans complex, is the site of the 160-acre alpine unit of Denver Botanic Gardens. Located in Arapaho National Forest and established in cooperation with the U.S. Forest Service, this unit was classified as a natural area by the Secretary of Agriculture in 1957, chiefly to protect the large stand of bristlecone pines and alpine grassland rich with alpine flora. The Forest Service has ruled that the area be used only for purposes of education and research. Denver Botanic Gardens is unique in the United States in having a natural alpine unit. In fact, few botanic gardens of the world can claim the distinction—from Tropics to Tundra.

The guide may be purchased for \$1 at Denver Botanic Gardens Gift Shop or at the Forest Service Ranger Station in Idaho Springs. Profits benefit our Kathryn Kalmbach Herbarium. Accompanying drawings and descriptions are taken from the guide.

BEP



Sibbaldia



Moss Campion



Piemy Bitterroot

Birds Cordially Invited

Virginia Faxon

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Sightings by casual bird observers in Denver Botanic Gardens suggest that it is already a haven for a variety of birds, including both rare visitors and those more common to city gardens and parks. The addition of a new specially planned Bird Sanctuary on the southern border of the Gardens, just east of the Rock Alpine Garden, excites speculation about future possibilities for birds here.

The Helen K. and Arthur E. Johnson Foundation, well known for past support and interest in the Gardens' development, funded the Bird Sanctuary as "a teaching collection of conifers, flowering trees, and shrubs with spring blossoms and fall fruit to attract birds into the home landscape." The Sanctuary was designed by Gayle Weinstein, botanist-horticulturist, with the advice and help of a committee of interested experts and friends.

The border location of the berm serves as a screen, giving privacy to neighboring homes to the south, yet providing an open vista of the Gardens to the north. On the south slope needles, cones and tree debris form a natural ground covering. A wide timber and mulch pathway separates this informal south slope from the more formal northern one

Virginia Faxon, an Associate of Denver Botanic Gardens, has served the Gardens in many areas as a volunteer. She is a member of Denver Audubon Society and the Denver Field Ornithologists.

featuring water, interesting shrubs and groundcover. Several established trees and some recently planted conifers are in place and will enhance the Sanctuary's appearance as this spring's plantings take root.

Recently introduced conifers, presently absent in the garden, and other flowering, fruiting trees and shrubs will expand the Gardens' collection. Many species are neither native nor those most familiar and available, but they promise similar or equal value for birds and suggest wider choices for home landscapes. As an example, *Crataegus punctata* Jacq., newly introduced here, was selected for its interesting horizontal canopy differing from other hawthorn varieties planted in bordering areas.



Crataegus punctata

Plants chosen will offer abundant food in the form of buds, blossoms, fruits and seeds along with the accompanying insect life so important to many birds. The need for ample cover, shelter and nesting

sites was another prime consideration in selecting the 37 species of trees, 30 shrubs and 18 ground covers, vines and herbaceous perennials in the plan.

Among the new and unusual plants for the Bird Sanctuary are three lacebark pines (*Pinus bungeana* Zucc.) with dull gray bark that flakes off to expose green to cream-colored branches and trunk. Often grown multi-stemmed, these pines were planted in spring 1982 at the eastern loop in the pathway. Amur chokecherry (*Prunus maackii* Rupr.) also has distinctive bark, yellowish-brown but peeling in strips. This grows at the bend in the pathway near the south center of the Sanctuary. A golden larch (*Pseudolarix amabilis* Rehd.), a deciduous conifer whose tufts of soft green needles drop in autumn, is located to the west and across the pathway from the first of three large green ash trees. Tree-lovers will also be intrigued with the dawn redwood (*Metasequoia glyptostroboides* H.H. Hu & Cheng), an ancient deciduous conifer that formed many of our petrified forests. Said to resemble the redwood of the west coast, it will be placed against the south fence slightly west of the center of the Sanctuary.

These "stars" in our tree landscape, along with the more common trees, will offer shelter, food and nest sites. Evergreens have special value since they continue to give dense shelter throughout winter and their seeds are plentiful and long-lived.

Flowering, fruiting trees and shrubs attract insects, as home gardeners know. Popular spring migrants, such as warblers, enjoy these insects. Many insects emerge from dormancy before the leaves are fully developed, thus giving the bird-

watcher a good chance to spot the birds. Some trees and shrubs have fruits that cling and continue to be edible through winter and even into spring. Thirty different species of fruit-bearing shrubs will give the fruit-eating birds such treats as mulberries, blueberries, raspberries, chokecherries, currants and elderberries along with other more long-lasting berries and rose hips.

An interesting new shrub,

Callicarpa bodinieri Lev. var.

geraldii (Rehd.) Rehd. 'Profusion', a form of beauty-berry, will have lilac-colored flowers in August and pink and purple foliage and violet, pea-sized berries in autumn. A group of them will front a green ash tree at the west end of the Sanctuary.

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Beauty-berry in winter fruit

Water for drinking and bathing is a great asset for attracting birds. The small pond, two waterways and the large boulders with cavities for holding water should also lure birds into view. A variety of ground covers will enhance the plantings and, along with a few perennials and grasses, produce foods such as nectar during flowering and later berries and seeds. Birds that like cover while they feed on the ground should benefit from some of these low plants. *Geranium sanguineum* L., *Penstemon eatonii* Gray, and *P. pinifolius* Greene normally attract insects, an important source of protein for birds and an attraction too often neglected in home gardens.

Birds are adaptable and opportunistic creatures, especially in their feeding habits. While particular birds are called seed, insect, berry, or fish eaters, these terms may indicate the birds' preference or most dominant food, but their actual diet will depend on location and what is available and abundant. Although some birds do restrict their diets to special plant or animal food, even birds with very special adaptations for a particular food often eat other things. For example, hummingbirds with long thin bills for sipping nectar also eat spiders and insects; red crossbills, with crossed bill tips for extracting seeds from cones, are fond of aphids and spring buds. Studies of robins' stomachs show different proportions of animal and vegetable foods in different seasons and locations but their diet is believed to be close to half insects and worms and half fruits when both are readily available.

Feeding habits can also change rather dramatically. The American goldfinch now prefers thistle and dandelion seeds which became available only after these weeds were introduced by European settlers. A rich assortment of plants with many seeds and berries for winter is expected to satisfy needs of many birds. Some more enduring fruits such as the relatively tasteless berries of the kinnikinnik (*Arctostaphylos uva-ursi* (L.) Spreng.) may not be eaten until very late in the season after more tasty foods have been consumed. With the number of different fruits, berries and seeds the Sanctuary and Gardens offer, it may be instructive to watch for bird preferences.

Inviting birds to Denver's city gardens is challenging. Although about 440 bird species are known to



visit Colorado, the everyday bird population in any one habitat is not impressive compared with those found in many other states. Yet as a state with altitude variations of over ten thousand feet, Colorado offers a wide variety of life zones with its grasslands and arid plains, its canyons and foothills, its mountain cliffs, forests and parks, and its unique alpine regions. Each environment has its own plant and animal associations and thus its own bird population. Denver is unusual in being an irrigated, green, well-planted city located on the prairie between eastern plains and nearby rocky foothills. Many streams run through or near the city and form networks around it, with lakes and reservoirs close by.

All these features account for bird visitors from nearby environments, who, at least occasionally, find convenient resting places in city gardens as they migrate with the seasons or seek shelter and food during adverse weather. These features also have enticed eastern birds, such as the blue jay, to take up residence in limited numbers. So while the possibilities for sighting a wide variety of birds within the city are marvelous, they are extremely unpredictable. The bird-watcher needs patience, alertness and some understanding of the factors influencing bird movements along with hopeful expectation.

With such unpredictability in mind, we might indulge in some more specific anticipation of events soon to be real possibilities in the Bird Sanctuary.

Upon admiring the great variety of evergreen fir, spruce, juniper and pine in a winter month, one might become aware of a regular one-note call. Locating the bird with binoculars (almost a necessity for bird-watching), we find it is a Townsend's solitaire, obligingly sitting in full view on the tip of an upright juniper. He is a graceful gray bird who takes up residence in the Gardens in winter, feeding on berries and rose hips. As spring approaches he often warbles an especially sweet song.

Again in mid-winter, a flock of unusually beautiful crested Bohemian waxwings might drop into the Sanctuary to gorge on fruits of serviceberry, snowberry or other shrubs. The waxwings appear sporadically in fall and winter but do not stay. Along the pathway in early spring, a scratching sound from the underbrush might direct our attention to the rufous-sided towhee, a handsome bird that forages for insects and berries or fallen seeds from the conifers.

Or imagine that it is May; the dotted hawthorn is in full bloom and we spot a small yellow, black and white, yellow-rumped warbler darting about among the new blossoms and leaf buds searching for insects. A robin with a beak full of nesting material flies into a lower branch of a green ash tree. His cheerful, persistent song is heard regularly in the spring and summer especially near dawn and dusk. From above in late spring we hear the trilling of a hummingbird who drops down for nectar from the red

columbine at the west end of the Sanctuary.

Later, before a summer concert, several mourning doves fly swiftly across the west end of the Gardens. Upon further investigation some are found walking about on walks and turf looking for seeds, and one is drinking from the Sanctuary pond. Visiting again in fall, the fortunate observer may spot a red-breasted nuthatch hanging upside down as he searches upper branches of a young conifer for insects and later running up and around the trunk, his tiny bill probing for grubs under the bark. Nearby on a group of boulders, a perky migrating rock wren, with his tail tilted up, hops about. 183

Regular observations to record birds seen at Denver Botanic Gardens are underway. We can look forward to the years ahead as the Bird Sanctuary plantings gradually mature, increasing in beauty and ability to attract an accumulating number of birds and observers. □

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Birds In Urban Denver Yards

Hugh E. Kingery

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Backyard bird watching is a favorite pastime of many urban dwellers. Birds need not only food but also cover and water. The plants in your landscape influence which birds will visit your yard. Knowing food and habitat preferences of birds can be helpful in selecting plants to attract a greater variety of birds.

Compiled by Denver Audubon Society, this list of birds shows the species found most frequently in urban Denver gardens. No yard will have them all, and many will host other species as well.

The birds are listed by feeding and cover preferences. Some species feed on the ground and like brushy cover. Others feed on seeds and fruit using trees for food and cover, and some prefer trees for their insect populations—some fall into both categories. Chickadees and nuthatches feed on both seeds and insects but are included with seed eaters because, as winter residents, they are attracted to feeders filled with sunflower seeds or suet, the latter a substitute for insects.

Insect eaters include only migrants and summer residents. If you spray your trees vigorously, you probably will not attract many of these species—at least not if the spray works—for you will have done away with their food source.

Some species not fitting into the other categories are: hawks which feed on small birds or mice; woodpeckers, which eat mainly insects; and many species, including flickers, jays, grackles and starlings, which eat almost anything.

Not included are birds which feed mainly on insects overhead, such as nighthawks and gulls, or birds such as geese and ducks seen in the sky en route to other places.

The classifications are arbitrary but emphasize that different birds need different foods and habitats.

Hugh Kingery, President of Denver Audubon Society and member of Denver Field Ornithologists, writes a column on the bird census of a four-state region—Colorado, Utah, Wyoming and Nevada—for *American Birds*, a bimonthly journal devoted to birds of the Americas. With his wife Urling, he teaches classes in Beginning Bird-watching for the Denver Audubon Society.



Plans are underway to combine bird-sighting data with plant information in preparing a slide program and pamphlet, "Birdscaping—how to plant your yard in urban Denver to attract birds."

Input from readers of *The Green Thumb* magazine relating to their experience with birds in their yards and plants that attract them is welcomed and may be sent to DAS, 1720 Race Street, Denver, 80206. 185

SPECIES	STATUS
GROUND BIRDS	
Thrush, Swainson's	M
Hermit	M
Rufous-sided Towhee	M
Juncos	W
Sparrow, Tree	W
Chipping	M
White-crowned	M
TREE BIRDS::	
SEED AND FRUIT EATERS	
Blue Jay	Y
Chickadee, Black-capped	Y
Mountain	Y
Nuthatch, White-breasted	W
Red-breasted	W
Brown Creeper	W
Robin	S
Waxwing, Bohemian	W
Cedar	M
House Sparrow	Y
Northern Oriole	S
Western Tanager	M
Grosbeak, Black-headed	S
Evening	W
House Finch	Y
Lazuli Bunting	M
Pine Siskin	M
American Goldfinch	W

INSECT EATERS	
Broad-tailed Hummingbird	S
Western Wood Pewee	M
Kingbird, Eastern	S
Western	S
Barn Swallow	S
House Wren	S
Kinglet, Golden-crowned	M
Ruby-crowned	M
Vireo, Red-eyed Vireo	M
Warbling	M
Warbler, Orange-crowned	M
Yellow	S
Yellow-rumped	M
Wilson's	M

OTHER	
Hawk, Sharp-shinned	W
Cooper's	W
Sparrow	Y
Dove, Rock	Y
Mourning	S
Flicker	Y
Woodpecker, Downy	Y
Hairy	W
Magpie	Y
Crow	Y
Townsend's Solitaire	W
Starling	Y
Common Grackle	S

Key to status

M = Migrant W = Winter
 S = Summer Y = Year-round

Colchicums, A Late Summer Surprise

Leah Brown

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Every year, in late summer, giant spring-like crocuses suddenly burst into flower near the entrance to Boettcher Memorial Center. Each year, too, these showy orchid-colored blossoms bring pleasant memories of colchicums that grew beneath the oaks in my mother's North Denver Garden.

Forty, or perhaps 50, years ago she was intrigued by an advertisement which read something like this: "Buy these bulbs and lay them on your window sill. They will bloom for you without soil and water." She *invested* in three for this was the Depression. Two did as the ad said, the third died. So content were these bulbs in the sandy loam that they brightened several areas in her garden. She also enjoyed them in low flower arrangements, and from the smaller blooms she fashioned long-lasting corsages.

Although the lovely *Colchicum autumnale* L. is often called meadow saffron or autumn crocus, in reality it belongs to the lily family. (Crocus belongs to the iris.)

Good garden soil or sandy loam is the only requirement. Plant the tall bulbs in early August so that the tips are about three inches below the surface of the ground. The less you disturb them the more they will increase and soon you'll have a well-established colony. They like full sun



but also enjoy partial shade. They are excellent material in a rock garden, under a specimen tree or in front of shrubbery. I have found them free of disease and insects.

In the spring a tube appears which opens into three or four leaves. These are broad at the base and taper to a point. They are about 3 inches wide and 8 to 12 inches long with smooth wavy edges, much the shape of lily-of-the-valley leaves. As the leaves mature, for a short while that spot in the garden will be untidy but do not cut off this foliage, it affords food for the flowers.

Then when you least expect it the beautiful orchid- to purple-colored flowers appear profusely without foliage from late August through September. The most common variety is *C. autumnale*. Some catalogs list five or six varieties. 'Waterlily' is a double pink; 'Violet Queen' boasts deep violet blossoms with a white throat.

If you want a highlight in your late summer garden, one that furnishes admiration and surprise, plant a bed of colchicums—spring will stage a dramatic return in September.

Gramineae (Poaceae), The Grass Family

Helen Marsh Zeiner

The grass family, Gramineae (Poaceae), is a very large and important family of highly specialized Monocotyledons. Of all the families of flowering plants, the grass family is considered to be of greatest use to man.

No other plant family can compete with the grasses as a source of food, both for humans and for domestic animals. All of the cereal grains which provide such a large part of the staple diet of people throughout the world are grasses. (A cereal grain can be defined as a grass whose seeds are used for food.) Among the most important of the cereal grains are wheat, rice, corn or maize, oats, rye, millet, barley, sorghum, and various wild grasses.

In addition to providing a large part of the human food supply of breadstuffs and cereals, the cereal grains are useful to man in other ways. Corn, for example, is an important source of oil both for food and for use in industry. Starch and alcohol are derived from wheat and corn and sometimes other grains. Barley is important in the production of malt and, in Colorado, is a part of an important brewing industry. The millets are important cereal grains for human food in Japan and Africa, but in many other parts of the world they are an



Alpine Timothy—*Phleum alpinum*

important source of bird seeds, including seeds for domestic fowl. The seeds of various wild grasses have always been used as food by primitive peoples and were widely used by the American Indians. Today wild rice in its natural habitat is gathered by Indians and sold as a gourmet food.

The seeds of sorghum are cereal grains, but the stems provide a sweet molasses-like syrup. Sugar and molasses are derived from sugar cane. Bamboo shoots are used as vegetables in the Orient.

The grasses have many uses not related to the human food supply. Many grasses, classed as forage grasses, are planted for pasture and often cut for hay. Some grasses,

Helen Marsh Zeiner, Ph.D., Honorary Curator of the Kathryn Kalmbach Herbarium and former professor of botany at the University of Denver, received her doctorate from the University of Indiana and, since, has had a special interest in grass taxonomy.

particularly corn and sorghum, are used as silage.

Range grasses provide wild pasture. In eastern Colorado, blue grama grass and buffalo grass are very important as wild pasture. For the United States as a whole, about 140 grasses are important native forage plants.

Grasses are planted in crop rotation programs to improve soil. They are also planted to hold soil and prevent erosion, often on road cuts. Those with rhizomes are excellent for this purpose. Golden Gate Park in San Francisco is a classic example of how soil-holding grasses can be used to stabilize sand and make a waste area of use to man. An area of dunes and shifting sand, Golden Gate was first planted with beach grasses to hold the sand in place

and then with shrubs, trees, flowers, and other grasses to create a beautiful permanent park.

Plume grasses, blue fescue, and ribbon grass are familiar examples of grasses planted as ornamentals. Lawns and golf courses are also considered as ornamental uses of grasses.

There are many miscellaneous uses for grasses. In some parts of the world they provide necessary fibers. Some contain fragrant oils used in perfumes. Brooms are made from broom corn, a sorghum. When the dryland farmers first came into eastern Colorado, broom corn was an important crop which could be grown with little water.

Bamboos, the largest of all the grasses, are used in countless ways. They have hollow woody stems which can be split and flattened to provide lumber for floors and walls. The stems are so strong that they are sometimes used for scaffolding in the Orient. The stems have airtight and waterproof joints and are often made into containers. With the partitions removed, they are used as water pipes. In this country, many people have fished with bamboo poles, or purchased a rug rolled on a bamboo pole.

This is but a sampling of the many uses of grasses. There are hundreds of ways in which they are useful to man—even to providing him with corncob pipes!

Distribution

The grasses are widely distributed throughout the world in a great variety of habitats which range from deserts to marshes, from prairies to woodlands, from the equator to the polar regions, from sea level to perpetual snow on



Blue Grama—*Bouteloua gracilis*

mountain tops. There is probably no habitat where plants can live that does not have at least one grass growing there.

Grasses often cover very extensive areas forming the grassland biomes, major world-wide ecological units. Most of central and western United States is a grassland biome. Southeastern Europe has its grassland biome, and the grasses extend across central Asia south of the coniferous forests. In the southern hemisphere, much of Argentina and much of Australia are in grasslands.

The grassland biomes of the world occur where the rainfall is too low to support forest life but is higher than that which results in deserts. This is generally between 10 and 30 inches of annual precipitation, depending on temperature and seasonal distribution.

In North America the grassland biome is divided into east-west zones determined by rainfall: tall grass, mixed grass, and short grass prairies. The grasslands of eastern Colorado belong to the mixed grass prairie, although most of the area is at present in a short grass disclimax (disturbance climax) due to over-grazing.

Morphology

In order to identify grasses, it is necessary to recognize the unique structures found in this family and to learn some new terms.

Identifying grasses at first seems difficult because of the new terminology and the fact that the parts are very small, with measurements of a few millimeters distinguishing one grass from another. A good microscope is necessary for serious work with grasses. However, it is possible to

learn to recognize some of the common genera without such detailed observations. Once you become familiar with grass morphology it is not as difficult as you may think to identify some of the common grasses, at least to the genus.

Although the grasses are Monocotyledons, the flowers and flower clusters are different from those of other Monocotyledons. During the processes of evolution they have undergone changes which make them unique. Most of the changes have been reduction or elimination of parts, probably from some lily-like ancestor. A typical grass flower, for example, consists of stamens (usually three) and a pistil (usually with two feathery styles). The flower lacks typical perianth parts, although the lodicules (two or rarely three

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Alpine Brome—*Bromus frondosus*

minute, thin, translucent or fleshy scales located outside the stamens in some grasses) are believed to be greatly reduced rudiments of a perianth. When the stamens are mature, the lodicules fill with water and push the flower open, freeing the stamens. Each flower is subtended by two bracts, the lemma and the palea. This constitutes a floret. The florets are arranged into spikelets. In studying the morphology of grasses, the spikelet is a good starting point.

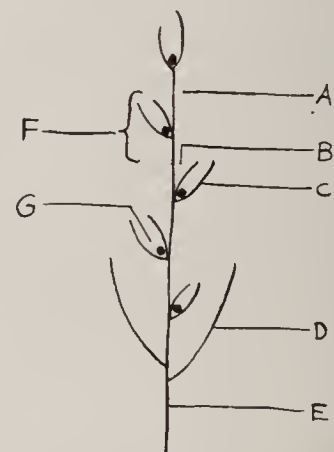
A spikelet, the ultimate division of the inflorescence, is made up of two bracts called glumes and one or more florets. A spikelet is an aggregation of flowers into a definite structure comparable to the head of a composite. In identifying grasses we do not pay as much attention to the flower itself as we do to the various bracts that make up a spikelet.

Let us see how a spikelet is arranged. In the center of the spikelet there is a small stalk called the rachilla to which the other parts are attached. A pair of bracts, the glumes, are found at the base of the spikelet. The lowermost glume is called the first glume; the upper glume of the pair is called the second glume. Just above the second glume a similar bract called the lemma is to be found. The flower is formed in the axil of the lemma. The second bract accompanying the flower is the palea. It is the inner bract of the floret and occurs between the flower and the rachilla. The florets are arranged in two ranks.

In identifying a grass the size and nature of the glumes, lemma, and palea are of utmost importance. The number and arrangement of the veins, called nerves, are one of the most important considerations. The

first and second glumes often have different numbers of nerves. Lemmas usually have an even number of nerves.

Vegetative structures in grasses are also unique. The typical stem, called a culm, is cylindrical with conspicuous nodes or joints which are solid and internodes which are hollow (rarely solid). The leaves are almost always long and narrow, the well known "blade of grass". Each leaf has two parts—the blade and the sheath which encloses the culm and attaches the blade to the node. Sheaths may be closed or split (open). The leaves are two-ranked, one at each node. At the junction of the blade and the sheath, on the inner side, is a small membranous or hairy appendage known as a ligule. The ligule is often an identifying character for distinguishing one species from another. Some grasses have a pair of appendages, the auricles, at the



Weeping Brome
Bromus frondosus (Shear) Wooton & Stand.

Alpine Timothy
Phleum alpinum L.

Blue Grama
Bouteloua gracilis (H.B.K.) Lag.

Diagram of Grass Spikelet:

- A - Rachilla
- B - Palea
- C - Lemma
- D - Glume
- E - Pedicel
- F - Floret
- G - Flower

base of the leaf blade. When present they are important in identification.

The usual grass fruit is a grain or caryopsis, in which the seed adheres so closely to the ovary wall that the entire structure appears to be a dry seed.

Any manual of grasses will have a glossary to which you can refer to familiarize yourself with the new terminology. Some will also provide helpful illustrations.

Classification

The grass family is so large that, for convenience, it is divided into two subfamilies; these are then divided into tribes. This has been done for at least 200 years, so it is a well-established practice. It does not always reflect true phylogenetic relationships, but it provides a relatively easy way to identify grasses. It is estimated that there are at least 5000 species and 500 genera in the family. Because taxonomy is uncertain in some cases, the numbers of species and genera are variable depending upon the authority citing the numbers.

For the world as a whole, as many as 27 tribes are sometimes listed. In the United States there are 14 tribes; 12 of these have been listed for Colorado.

For an introduction to the grasses, let us consider briefly the two subfamilies and the tribes into which they are divided.

Subfamily FESTUCOIDEAE

Spikelets 1-to many-flowered; reduced florets (if any) above the perfect florets, with a few exceptions. Articulation usually above the glumes; spikelets more or less laterally compressed.

Tribe I. BAMBUSEAE, Bamboo Tribe.

A woody perennial culm is the unifying character in Bambuseae, but it is not a very stable character. Although bamboos are separated from other grasses because the culms are woody and perennial, some other grasses do have woody culms, and some bamboos have wiry culms. Therefore the characteristic of the woody culm is not infallible, but it works in most cases.

Bamboos are widely distributed in tropical and subtropical regions in both hemispheres. One genus, *Arundinaria*, occurs in southern United States where it grows in dense clumps along rivers forming what are known as canebrakes.

The largest of the grasses, bamboos vary from 2-3 inches to 100 feet tall. The diameter of the culm varies from small and wiry as in common grasses to 6 inches or more. They are hollow and woody and live for many years. Because the culms are woody, the large species have many uses such as for lumber and containers.

In Colorado bamboos are grown strictly for ornament in greenhouses and conservatories and occasionally in homes. Since they are not naturalized, bamboos are omitted in lists of Colorado grasses.

Tribe II. FESTUCEAE, Fescue Tribe.

Key characteristics for Festuceae are 2- to several-flowered spikelets, with the glumes shorter than the first floret. The spikelets are in open, narrow, or spike-like panicles, rarely in racemes. The lemmas are awnless, awned from the tip, or awned between two minute teeth at the apex of the lemma. The awns are straight.

This is a large and important tribe mainly of temperate and cold regions of the world. Many well-known grasses belong here and the tribe is well-represented in Colorado.

Among the important genera are *Bromus*, the brome-grasses; *Poa*, the blue-grasses; *Dactylis*, orchard grass; and *Festuca*, the fescues. Many useful grasses belong to this tribe, as well as some troublesome weedy grasses such as cheat grass, *Bromus tectorum* L.

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Tribe III. HORDEAE, Barley Tribe.

Grasses in this tribe are characterized by 1- to several-flowered spikelets which are sessile on opposite sides of the rachis, forming a symmetrical spike. Spikes are terminal and solitary.

These are grasses of temperate regions, and many grasses of economic importance belong here. Hordeae includes the cereal grains: wheat, barley, and rye. Familiar Colorado native grasses such as *Agropyron*, the wheat grasses that are important native forage plants, and *Elymus*, wild rye, belong to Hordeae.

Tribe IV. AVENEAE, Oat Tribe.

Spikelets are 2- to many-flowered with glumes as long or longer than the first floret, and usually as long as the spikelet. Lemmas are awned from the back with an awn which is usually bent or twisted. The inflorescence is usually a panicle, sometimes narrow and spikelike.

A small tribe widely distributed in temperate regions, Aveneae is known for the cereal grain oats. Among the common Colorado grasses belonging to this tribe are: *Danthonia*, oatgrass; *Trisetum*,

trisetum; and *Koeleria*, Junegrass.

Tribe V. AGROSTIDEAE, Timothy Tribe.

Agrostideae is characterized by 1-flowered spikelets. Occasionally some 2-flowered spikelets may be found in an inflorescence, apparently an indication that the 1-flowered condition was reached by reduction from a many-flowered ancestor.

Agrostideae is a large tribe of about 50 genera native to temperate and cool regions. About 25 genera occur in the United States.

Phleum, timothy, is an important grass often planted for hay. *Phleum alpinum* L. is a closely related grass to be found at high altitudes in Colorado. The bent grasses, *Agrostis*, of golf courses belong here. *Agrostis alba* L., red top, is a valuable forage plant in wet meadows. Several species of *Stipa* are important native grasses in Colorado.

Tribe VI. ZOYSIEAE, Curly Mesquite Tribe.

In Zoysieae the spikelets are sessile in groups of three which fall as a unit.

This is a small tribe represented in Colorado by *Hilaria jamesii* (Torr.) Benth., galleta, which grows in dry areas at lower altitudes. Curly mesquite, *Hilaria belangeri* (Steud.) Nash., is an important range grass in arid and semi-arid regions of the southwest and a dominant short grass on the Texas plains.

Tribe VII. CHLORIDEAE, Grama Tribe.

Spikelets are 1-to several-flowered and sessile on one side of the rachis,

forming one-sided spikes or spike-like racemes. Chlorideae is an easy tribe to recognize because of the one-sided spike. It is a large and significant tribe, found mostly in warm regions.

Buchloe dactyloides (Nutt.) Engelm., buffalo grass, and *Bouteloua gracilis* (H.B.K.) Lag., blue gamma, are important dominants in short grass prairies where they are valuable forage grasses. They "cure on the root" and provide food in winter. They are important grasses in eastern Colorado. Buffalo grass forms a very dense sod which was used by pioneers to make sod houses.

Tribe VIII. PHALARIDEAE, Canarygrass Tribe.

Spikelets have one perfect terminal floret and below that a pair of staminate or neuter florets.

Phalarideae is a small tribe represented by three genera in the United States: *Phalaris*, *Hierochloe*, and *Anthoxanthum*. *Phalaris* is represented in Colorado by several species, including *Phalaris canariensis* L., a source of commercial bird seed, and *Phalaris arundinacea* L. and its cultivated variety *P. arundinacea picta* L. which is an old-fashioned ornamental known as ribbon grass. *Hierochloe odorata* (L.) Beauv., sweet grass, gives off an odor of vanilla as it starts to dry. It can be found in the Colorado mountains to timberline. *Anthoxanthum odoratum* L., sweet vernal grass, has been collected in Colorado possibly from cultivated plants.

Tribe IX. ORYZEAE, Rice Tribe.

This is a small tribe of wet-land grasses important because cultivated rice, *Oryza*, one of the

most important of all the cereal grains, belongs here. Rice is native to the East Indies but is now grown in many countries. It was introduced into southern United States in 1694 and is now an important crop.

In Colorado this tribe is represented by one genus, *Leersia*, in the northern two-thirds of the state in wet places at low altitudes.

Tribe X. ZIZANIEAE, Wild Rice Tribe.

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A small tribe of aquatic or subaquatic grasses occurring in warm, temperate, and tropical regions. One genus, *Zizania*, wild rice or Indian rice, was planted in a pond in El Paso County, Colorado, for wild fowl food. It did not become permanently established but is listed in Colorado manuals because it was collected at this site.

Tribe XI. MELINIDEAE, Molasses Grass Tribe.

An unimportant tribe represented in southeastern United States by one introduced species. It does not occur in Colorado.

Subfamily PANICOIDEAE

Spikelets with one perfect terminal floret and a sterile or staminate floret below, usually represented by a sterile lemma only. Articulation below the spikelets. Spikelets more or less dorsally compressed.

Tribe XII. PANICEAE, Millet Tribe.

The spikelets have one perfect terminal floret and a sterile floret with two glumes beneath it. The spikelets are not paired. The lemma and palea are harder than the glumes.

This is a large and taxonomically difficult tribe with relatively few members of economic importance. They are mostly grasses of warm regions.

The genus *Panicum* is one of the largest genera of grasses, with 160 species in the United States. It is estimated that one-fourth of all United States grasses belong to *Panicum*. They have little, round, compact spikelets. Some known as millet are used as cereal.

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Setaria, foxtail or bristle grass, is a familiar genus. Some species of *Setaria* are weedy; others are cultivated millets. Barnyard grass, *Echinochloa*, is common in wet places in Colorado. Crabgrass, *Digitaria*, is a member of Paniceae. Sandbur, *Cenchrus*, is a troublesome weed in dry, sandy places in eastern Colorado. The genus *Pennisetum* contains some lovely ornamental grasses which can be found growing in Denver.

Tribe XIII. ANDROPOGONEAE, Sorghum Tribe.

Andropogoneae has spikelets similar to those in Paniceae, but the spikelets are always paired. This is a large tribe found mostly in warm climates but also well-represented in temperate regions.

Sugar cane, *Saccharum officinarum* L., is the most important plant of the tribe. *Sorghum* is an economically important genus for sorghum molasses and for several cereal grains some of which are grown for chicken feed. Johnson grass, *Sorghum halepense* (L.) Pers., was brought into the southern states for forage on worn out cotton fields and is now a troublesome weed in some locations. The Andropogons, beardgrasses, are

wild hay grasses in prairie regions. Several beautiful large ornamental grasses belong to Andropogoneae. *Eulalia*, *Miscanthus*, is an example and can be found in Denver.

Tribe XIV. TRIPSACEAE, Maize Tribe.

Members of Tripsaceae are the most highly specialized of all the grasses. It is a very small tribe regarded by some as a subtribe of Andropogoneae.

The spikelets are unisexual, in different inflorescences or in different parts of the same inflorescence. In corn the tassel is made up of staminate spikelets. The female spikelets are on the cob and the silk is the style and stigma. Cross pollination is usual. The grains (kernels) are in pairs on the cob because there was a pair of spikelets.

In the Americas the tribe is represented by *Zea*, maize or Indian corn; *Tripsacum*, gamagrass; and *Euchlaena*, teosinte, a possible ancestor of corn. In the old world *Coix* or Job's tears is a well-known representative of the tribe. □

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Illustration Sources

Front cover, page 171: Drawings by Frances Frakes Hansen
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Number Three



The Cover

Mushrooms

Frances Frakes Hansen

The Green Thumb

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Vol. Forty, Number Three

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Corrections: *The Green Thumb* 40(2): 164, 179, 189-190, 193.

With sincere apologies to the authors and artists concerned, we wish to make the following corrections to errors and omissions which occurred in *The Green Thumb*, Summer 1983. Please remove this page and insert it into your summer 1983 issue. Editor.

In "Gramineae (Poaceae), The Grass Family":

p. 189. The legend under the picture should appear as follows:



Weeping Brome—*Bromus frondosus*

p. 190, The last sentence in the top paragraph should read:
c. 2.

Lemmas usually have an odd number of nerves, while paleas, perhaps due to the pressure of the rachilla, usually have an even number of nerves.

p. 190. The legend under the illustration should appear as follows:

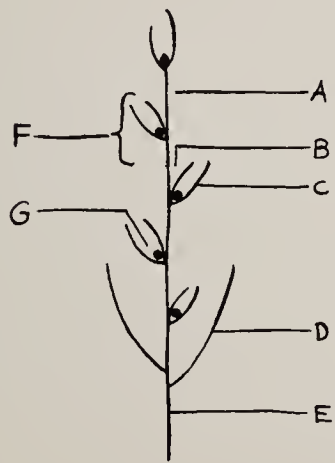


Diagram of grass spikelet:
A. rachilla E. pedicel
B. palea F. floret
C. lemma G. flower
D. glume

p. 193, Paragraph 2 should read:
c. 1.

...*Bouteloua gracilis* (HBK) Lag., blue grama...

In "Art and Artists...":

- p. 179. The name of the flower in the lower right hand corner of the page is Pigmy Bitterroot.



Pigmy Bitterroot

In "The Plains Garden at Denver Botanic Gardens"

- p. 164. The following should have appeared at the bottom of the page:
The original conceptual plan for the Plains Garden was done by
landscape architect Jane Silverstein Ries.

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Denver Botanic Gardens, Inc., maintains a collection of living plants, both native and exotic, for the purpose of acquiring, advancing, and spreading botanical and horticultural knowledge.

This is a non-profit organization supported by municipal and private funds.

“Buried” Treasure—the Mycology Research Program

Merle M. Moore

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Buried in the basement of the Education Building of Denver Botanic Gardens, near the end of the hall leading to classroom C, are two locked doors. Behind these doors, removed from the tours of the casual Gardens' visitor and unseen by most of the Gardens' staff, are some treasures worth knowing.

The door on the right is unmarked; the one on the left bears a sign “Research.” Behind the first is the Mycology Herbarium which now contains more than 15,000 collections of fungi, most of them mushrooms collected in Colorado. Over 1,000 species are represented and comprise the most complete collection of Colorado fungi in the state and probably in the world. All of these collections are labeled and annotated. Over 7,000 of them have been photographed on color transparencies or black and white prints. Nearly all have been described on filing cards which note their field characters as well as microscopic anatomy. These are necessary if the collections are to be used in publications or to be of value to future generations of mycologists for study or for teaching purposes.

Merle M. Moore, director of Denver Botanic Gardens, envisions a greater emphasis on educational and research programs as a future trend at the Gardens.

Already D. H. Mitchel, M.D., curator of this invaluable scientific collection has published more than 10 mycological and medical papers and co-authored three books on poisonous mushrooms and mushroom poisoning. Some of the collections are type specimens for new species he has described. Some are over 100 years old! These have been received in exchanges of specimens with other herbaria throughout the world. All these treasures are protected in standard herbarium cases and, with adequate care, will be preserved indefinitely even if all our forests are ravaged and our prairies eventually covered with asphalt.

The most valuable treasure is the Myxomycetes collection. This contains over 4,000 specimens representing more than 400 of the 500 species known worldwide, and nearly all of the 350 species found in the United States. Of these, 230 species have been collected in Colorado—a remarkable record! With these and the aid of permanent slides made while Dr. Mitchel and Shirley Chapman, assistant curator, visited the USDA Herbarium in Beltsville, Maryland three years ago and The New York Botanical Garden last year, at least 450 species of the 500 known species can be identified. Although these figures may not sound impres-

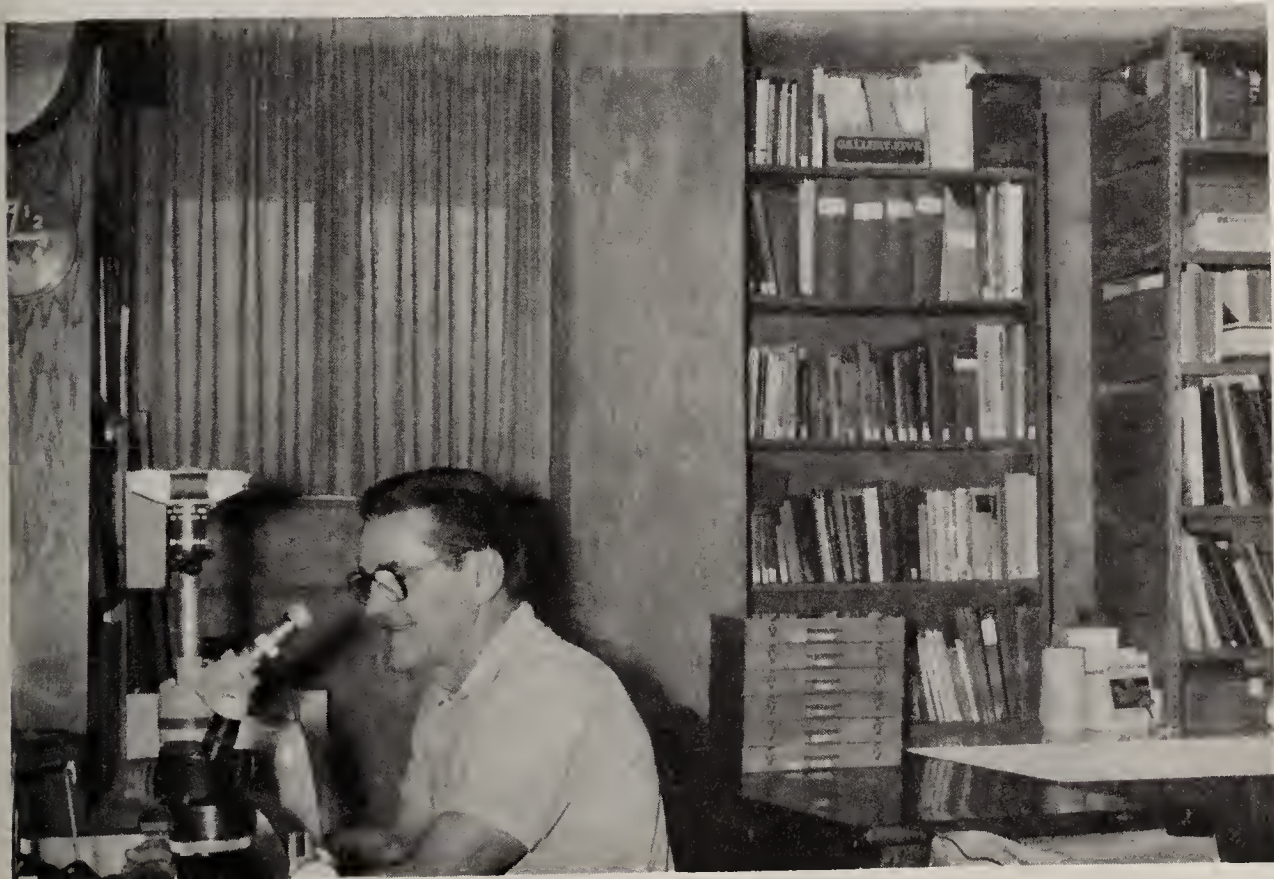
sive, this is one of the 15 most nearly complete Myxomycetes collections in the world.

So what are Myxomycetes?
Dr. Mitchel's answer follows:

This is a unique group of living organisms that have the rather unattractive common name of "slime molds." They are unique in at least five respects: They are among the smallest living things; they are exceedingly tough and survive under adverse conditions, from the arctic to the tropics, wherever other life forms are found; they are half animal and half fungus; they are the only living organisms that at one stage exist without cell walls (or membranes); and they are exquisitely beautiful.

When the spore (all fungi reproduce by spores rather than seeds) of a slime mold falls onto a warm, moist environment, its wall breaks (the spores do have walls) and from it comes one or more microscopic amoeba-like organisms. These move along on the moist surface of leaves, rotten wood, or even the bark of trees ingesting bacteria, pollen grains or other spores just as amoebae do—engulfing the particles, digesting them and excreting the remains. If the spores germinate in water, they produce swimming, flagellated (tailed), free-living micro-organisms that also ingest food particles from the water. As the moist environment changes from standing water to damp surfaces, these tiny "animals" can change

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Dr. D. H. Mitchel at work in the Mycology Lab

back and forth from the swimming, tailed form to the amoeba-like, gliding, oozing form, always ingesting food, growing and multiplying. If two or more of these groups or swarms meet, they may unite to form a larger mass which in turn may incorporate other smaller masses and so the process continues.

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The basic structural and functional unit of living organisms is the cell. All plants and animals are composed of cells from the one-celled amoeba to the whale or the giant redwood with billions and billions of cells. Each cell has a nucleus, where the genetic characters of the species and the machinery which runs the cell are stored, and a cell wall or membrane which protects the nucleus and stored food in the cytoplasm from all other cells and from the harsh external environment.



Jewel Box

Not so with the slime molds! As the amoeba-like organism grows its nucleus divides, as in the amoeba, but its cell wall does not divide. Soon this organism has formed a multinucleated, acellular, moving, devouring, digesting, excreting protoplasmic mass which defies the whole cellular theory of biology; and we, in our ignorance, have labeled this jelly-like mass "slime." With the assimilation of neighboring masses and their continued growth some of them may reach a square foot in size; some are microscopic. Most of them are small blobs of jelly from the size of a pea to the size of a golf ball varying in color through white, yellow, red, drab brown to black, similar to petroleum jelly or motor lubricant. Thousands of nuclei, all sharing the same food ingested by the common protoplasmic mass, all dividing simultaneously as if marching to the same drummer, or responding to some mysterious, built-in clock-like mechanism, form one of nature's truly communistic societies, even to the point of gobbling up their neighbors.

Some of the haploid nuclei unite, like a sperm and egg of higher plants and animals, to form diploid nuclei. Each nucleus, whether haploid or diploid, continues to divide simultaneously with its neighbors as the mass continues to ingest organic matter and grow in size. Then, at some equally mysterious signal, this "animal" suddenly undergoes a political and biological revolution. Its nuclei become highly individualistic, form walls around themselves, and join the "plant" kingdom (if you still like two kingdoms) as a fungus. The whole communal, shapeless, flowing mass becomes transformed into

one or thousands of stationary, intricately and beautifully formed fruiting bodies. As this occurs, the diploid nuclei go through a series of maturation divisions to produce the haploid spores for the next generation. The rest of the protoplasmic mass forms the intricate structures that support and enclose these spores.

Typically, these fruiting bodies (sporangia) have a stalk 1-5 mm long and a head 0.5-1 mm in diameter resembling a tiny mushroom button or a stalked puffball. The covering over the cap may be thin and iridescent, reflecting all the colors of the feathers of hummingbirds, or be thick and covered with lime like an egg shell. Inside the covering (peridium) is the capillitium holding the spores. Sometimes the capillitium is made up of simple branches from the top of the stalk, that when shaken free of spores, gives the whole sporangium the appearance of a tiny tree. More often the capillitium is an elastic net resembling cotton candy which fluffs out into cottony rolls dispersing the spores. The threads of these tiny nets are as thin as the threads of a spider web, often brilliantly colored—red, gold, yellow, or silvery-white. At higher magnification the threads themselves are seen to be exquisitely designed with spines or spiral bands like a golden rope. Some sporangia have a ribbed peridium resembling a minuscule, jeweled bird cage made of tiny lavender ribs with sparkling nodes at the junctions, hanging, like Japanese lanterns, from their delicate drooping stalks with pinkish-buff balls of spores in the center. Others are covered with a net of exquisite lace. But their beauty is



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Bird Cage

only part of the miracle of their formation.

If, in our macrocosm, an alligator feeding in a pool suddenly crawled out on the bank, stood upright on its tail, and turned into a tree with its skin becoming bark and its legs branching out into limbs bearing leaves and apples, all the while with a fish still flopping about in its stomach, we would call it a miracle. This, in essence, is what every true slime mold does in the course of its life; for bits of food are found remaining in the stalk and sometimes even in the capillitium of the mature fungus fruiting body.

Because of these unique characteristics the slime molds have been studied by biologists to



Tree

learn more about the beginnings of life and its diversification into different plant and animal life forms. Investigators in cancer research study them in an attempt to find the mechanisms by which cells signal each other to control their multiplication and specialization into different structures. A cancer cell resembles a slime cell in its uncontrolled division and growth, whereas the normal cells of the body have controlled growth and become specialized into different tissues according to a genetically-controlled program. Whatever makes the slime mold change its politics may also deter the cancer cell from taking over its pacifist neighbors.

Behind the second door marked "Research" is the Mycological Laboratory. Though only 16 x 13 feet in size, this room contains essential equipment for the study, classification, and cataloging of this outstanding collection of fungi. Ceiling-high bookshelves along three walls hold what Dr. Mitchel admits

is one of the most complete mycological libraries between the Mississippi River and the West Coast. Surrounded by dropper bottles of solutions and stains used in examining the microscopic anatomy of fungi, four microscopes stand ready for use—one a research triocular scope with a camera attached to take photomicrographs. Nearby is a tripod holding a camera with a bellows attachment, stroboscope and light for close-up photography. Drawers and cabinets contain supplies—dissecting tools, slides, culture dishes and other related equipment. In the center of the room stands an antique freezing microtome for slicing frozen sections of fresh fungi for microscopic examination.

Housed in this room are manuscripts, reprints, correspondence, and more than 7,000 photographs of fungi. In a desk and cabinets on it are filed the 5 x 8 cards with descriptions of the specimens in the herbarium. A chain-index file holds the inventory of the numbers of collections of each species, as well as listing the number of collections of each species from Colorado, those from other locations, and the total.

The contents of these two rooms, except for the herbarium cases and other furnishings, represent, for the most part, Dr. Mitchel's work for, and contributions to Denver Botanic Gardens during the past 20 years. He has contributed more than \$30,000 in books and equipment as well as thousands of hours of his time. He estimates that he has given a minimum of two hours per collection, with additional time spent in writing articles and preparing lectures.

He quickly points out that he could not have done this alone.

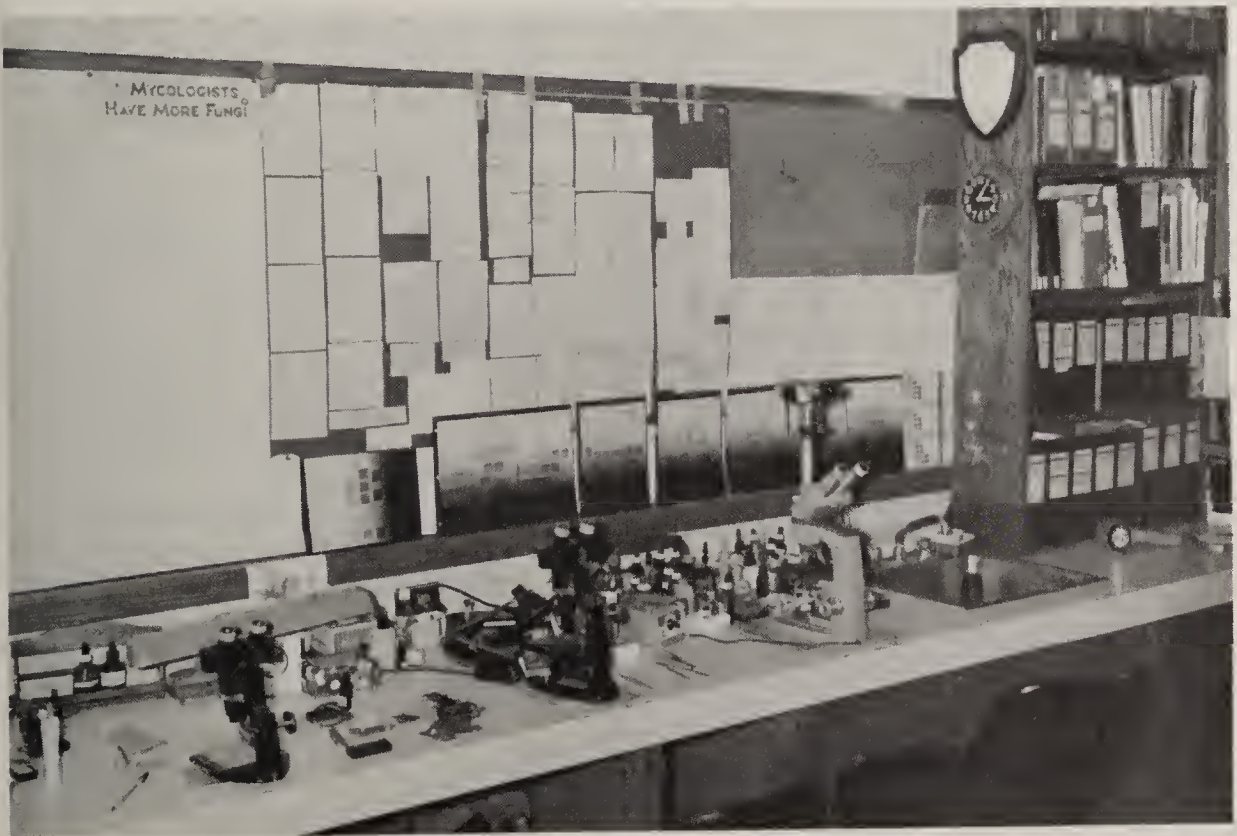
Shirley Chapman, assistant curator, has contributed almost as many hours per week as Dr. Mitchel has, over the past 16 years, doing most of the labeling, indexing, keeping the exchange records, and packing and shipping specimens to other herbaria. She has described and identified many of the collections, has co-authored two of the articles published by the Mycological Laboratory and helped, without recognition, to write others. She has also contributed many hours, at her own expense, collecting specimens. She has more specimens in the herbarium than any other collector.

Vera Evenson, a microbiologist by training, has contributed almost one day a week for the past six years to the herbarium, traveling at her own expense from Boulder, and has collected many of the specimens which she has examined and described in her own laboratory. She is co-author of the first volume on the genus *Hebeloma* which is being published in 1983, and will be the senior

author of the second volume which will be published in 1984 or 1985. George Grimes contributed many hours and collections during the two years he worked in the lab prior to the publication on the genus *Disciseda* which he co-authored.

Many nationally and internationally known authorities have visited the Mycological Laboratory and spent days to months working with the mycology staff in identifying specimens. Among them are Drs. Alexander H. Smith, Robert Shaffer, Orson Miller, Joe Ammirati, Kent McKnight, and Merideth Blackwell. These and many other mycologists from the United States, Canada, Great Britain and Europe have exchanged specimens with our herbarium and contributed their expertise in making identifications. Generous amateur mycologists from the North American Mycological Association and the Colorado Mycological Society have also donated collections.

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Equipment for research in the Mycology Lab

The mycology collection and the research which emanates from it are truly scientific treasures of Denver Botanic Gardens. In 1966 Dr. Mitchel established, by personal donation, The Mycology Research Fund which has provided almost exclusively, until recent years, the financial foundation for mycological research at the Gardens. More recently others have shared some of this responsibility with a notable contribution given by Mrs. George (Pauline A.) Morrison. Generous gifts from Priscilla Rea and from the late Florence Green as well as other smaller gifts from individuals and from the Colorado Mycological Society have also been added to this vital fund to support research in this area.

From its operating funds Denver Botanic Gardens, Inc. has allocated about \$10,000 during the past eight years toward expenses of the program. At its current level of operation the program requires about \$2,500 in funds each year to continue. If Dr. Mitchel were no longer able to continue as curator of the collection and carry forward the research objectives of the program, this cost figure could increase dramatically.

A discussion of the future of the program indicated that an endowment fund large enough to generate an annual operating budget for the mycology research program would be the most secure means of protecting this valuable investment. Experience shows that endowment funds are the most difficult to raise, and for a program of scientific value but little public visibility, even more challenging. However, if Denver Botanic Gardens is to go forward with this vital, relevant, and distinguished scientific program, this challenge must be confronted and met. □

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New Spaces for Living at Denver Botanic Gardens House

Gayle Weinstein

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It is interesting how some things are overlooked. At Denver Botanic Gardens we are continually adding new gardens and yet, for many years, there has been a garden

Gayle Weinstein, botanist-horticulturist in charge of the York Street outdoor gardens of Denver Botanic Gardens, designed the new outdoor “rooms” of the administrative house.

within. I am referring to the Denver Botanic Gardens’ Administrative House—a beautiful, traditional style home on the corner lot at Ninth and Gaylord. There is no backyard, only an extended front. Surrounded by trees that have been there 40-50 years, the setting is comfortable and calm. What is more enticing are all



the microclimates it provides for growing a variety of broadleaf evergreens and other plants untried in Denver.

Many of the administrative offices are housed within this beautiful, old home. The grounds outside, although well maintained, have been overlooked in providing functional space for the Gardens.

Merle Moore, director of Denver Botanic Gardens, several years ago envisioned some new possibilities for use of this urban residence and asked that a plan be designed to provide functional outdoor spaces suitable for special purposes for the Gardens and other organizations.

Dividing the outside space into three separate rooms was easy since there were three existing levels. Two of these terraces have enough open floor space to allow for large gatherings.

Although it is all front, there are many entrances to the yard. Of course you can enter it from the front door. But it can also be entered from York Street, from Ninth Avenue, from the driveway at the east end or from a somewhat hidden entrance at the west end. More intriguing is that each entrance offers a different perspective and only when you walk through the separate areas do you see the entire design.

Many of the plants used are exotic or on trial in this region. With an

imaginary walk around the areas, you may have a better understanding of the space.

My favorite entrance is the one off the driveway. You first step onto a curved sandstone path. On one side is a combination of European and Japanese white birch and on the other side are spruce and fir trees. Underneath their canopies is a variety of broadleaf evergreens, not usually planted in the Denver area—rhododendrons, azaleas, leucothoes, and pierises are a sample. There are also newly planted groundcovers of Japanese ground spurge and English ivy that by next year should provide a dense blanket through which tulips and daffodils will emerge.

As you walk on, the path curves toward the front of the house and terminates with a large expanse of lawn composed of a mixture of rye, fescue, and Kentucky bluegrass. Shrubs bordering the turf are selections of weigelas, hydrangeas, witchhazels, smoketrees, and Chinese dogwoods.

At this point you can see the entrance off York Street which also leads directly to the front door.

As you continue to the west, there are several steps that lead down into the next outdoor room. Here is another large turf area, composed of three selected Kentucky bluegrasses. Along one side is a semi-circular sandstone floor edged by a similarly constructed wall, built at a



convenient height for sitting. Directly west of the lawn are three sandstone benches bordered by additional exotic plants such as sweet bay magnolias, franklinia, and evergreen hollies. North of the wall is a pathway that follows the semi-circular pattern. It, too, features a sitting wall.

At this point you have climbed to the third room. This one is smaller, mostly intended for private conversations. There is no grass, just groundcovers, shrubbery and an informal path that leads to several sitting areas. At this level an inconspicuous exit leads to the back of the house.

This garden was planned as a functional part of Denver Botanic Gardens—a garden for visitors to use and enjoy. □

The redesigning of the front yard of Denver Botanic Gardens administrative house was made possible by a generous gift from Mrs. John Atkinson (Maxine Hartner Sawyer Atkinson) of San Diego, California in memory of her parents, Mr. and Mrs. Elmer Hartner. They purchased the house in 1929 and lived there until 1958, when it was purchased by Mrs. James J. Waring as a memorial to her father, Henry M. Porter. It was given to the Denver Botanic Gardens Foundation to be used as its headquarters.

Describing it as a home of “unusual artistry and comfort,” an article by Virginia McConnell Simmons titled “The House at 909 York” appeared in *The Green Thumb*, winter 1974. She tells something of the architecture and much of the history related to the house. It was designated a Denver landmark by the Denver Landmark Preservation Commission in 1973, and, in 1979, was included in the National Register of Historic Places.

In 1982 the Board of Trustees of Denver Botanic Gardens named the house at 909 York Street the Ruth Porter Waring Botanic Gardens House honoring Mrs. Waring for her long and dedicated service to Denver Botanic Gardens. Editor.

FOCUS ON

Abutilon

in the

Boettcher Memorial Conservatory

Peg Hayward

Abutilons, members of the mallow family (Malvaceae), occur as natives in the tropics and subtropics. Of the over 100 species of *Abutilon* Mill., most are shrubs and herbs; trees are rare. The name is of obscure origin possibly derived from an Arabic word for a mallow.

Ornamental leaves of the abutilons are alternate, long petioled, cordate at the base, sometimes lobed, usually toothed and frequently variegated. They are often maple-like which is responsible for the common name, flowering maple, even though the genus is not related to the maple genus, *Acer*, but is a botanical cousin of hibiscus, mallow, hollyhock, cotton and okra.

Attractive bell-shaped, pendulous flowers are solitary, axillary, with 5-parted calyxes and typically 5 obovate petals which are often handsomely marked with a network

of darker veins. The flowers look like a partly closed hibiscus resembling a Chinese lantern, which they are sometimes commonly called. Ranging in color from salmon to red, yellow, white and pink, the cheerful blossoms produced in profusion nearly all year around make the flowering maple a favorite for the greenhouse, window box or conservatory. The fruits are star-shaped capsules.

The following species of *Abutilon* are represented in the Boettcher Memorial Conservatory. *A. megapotamicum* (K. Spreng) St.-Hil. & Naud., native to Brazil, is one of the hardiest. It is of drooping habit, having slender stems clothed with small, green and yellow leaves. Conspicuous pendulous flowers on short stalks have lemon-yellow petals, bright red calyx, and the column of stamens is conspicuously protruding.

There are numerous named hybrids of *Abutilon*, collectively referred to as *A. hybridum* Hort. These are undoubtedly mutations of several species and are by far the most commonly grown.

Peg Hayward has long been associated with the Boettcher Memorial Conservatory and initiated its tour guide program. "Focus On" appears regularly in *The Green Thumb*. Her husband Phil Hayward, a well-known professional artist, is illustrator.



Abutilon hybridum—Flowering Maple

A. striatum var. *thompsonii* Hort. is one of the most beautiful. The flowers are attractive orange lantern-shaped with red veining. Large ornamental leaves are variegated green and yellow. The mottling on the leaves is caused by a virus which does not affect the plant's growth.

Like hibiscus many abutilons have strong stem fibers which are made into cordage when derived from mature stems. Young stems provide a softer fiber which can be woven

into fabric. In some places including Rhodesia, Ethiopia and most of Tropical Africa the seeds, leaves and roots are used for food and medicine. □

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An Englishman's Garden in the Rockies

Andrew Pierce

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My garden, situated in the Rocky Mountains at an elevation of almost 7,400 feet (2260 m), is perched on the southwest side of Independence Mountain high above Evergreen, Colorado. Here gardening takes on some interesting characteristics and challenges.

The soil structure is principally broken granite, from 20-ton boulders to fine grit. This certainly can be adapted to many rock garden plants; but at the same time, its marvelous drainage occasionally has to be curtailed. There is a limited amount of fine, slightly acid soil material, very low in nutrients; but this is quite sandy in character and dries out quite rapidly, thus requiring modification. My principal mix is two parts of fine soil (secured locally), and three parts of very well rotted horse manure (from the local dump, free for the carting). Some sections of the garden are built up according to the needs of the plants: with fine soil, peat moss and decomposing pine needles for ericaceous plants; with less peat and only a little of the broken granite for primulas.

Andrew Pierce, assistant director of Denver Botanic Gardens, is on the National Committee of the American Rock Garden Society, and chairman for the International Interim Conference of Rock Garden Societies to be held locally in 1986.

A factor not often of concern to lowland gardeners is the ultraviolet light. Its intensity at this elevation is considerable, though not as intense as in the high alpine country visible to the west of my garden. We also often fail to appreciate the effect of wind and air movement at higher elevations—a factor in the development of the typical cushion plants of the alpine tundra. Unfortunately, due to the protective ponderosa pine and Douglas fir forest in my area of the montane, this factor is somewhat diminished.

Gardening here is complicated by the uncertainty of weather conditions from season to season and from one locality to another close by even during the same day. One winter may produce over 12 feet of snow which may remain on the ground for four to five months, while the next winter may barely see 12 inches and there will be so

Although it is the general policy of *The Green Thumb* to include the authority with the scientific name of a plant when it first appears in an article, we have chosen not to include the authors in this article. We believe that, with the profusion of scientific names herein, the readability will be enhanced by their omission.

This article is a revision by the author of one titled "Rocky Mountain High" which appeared in the *Bulletin of the American Rock Garden Society*, 40 (1): 18-22. Editor.

many record high temperatures as to make one think of perpetual summer. Watering is required to alleviate the drought at times on the south side of the house while the north side (primula country) remains almost frozen due to the 10 to 20 degrees below freezing most mornings. Annual precipitation averages around 20 inches, but it may be plus or minus 10 inches; and because of the soil structure of decomposed granite the soil never stays wet for very long.

It is not persistent, extreme cold that damages our plants here but rather the extraordinary up and down shifts of temperature to which plants are subjected. One day can be in the 50's and the next, under a foot of snow, down to 10°F., frequently followed by the rapid disappearance of this snow cover as the Chinook or warm winds blow down from the mountains at speeds up to 60 m.p.h.

The growing season is comparatively short with frost-free days from

mid-June to the end of August—occasionally stretched by as much as six weeks in non-average years. Gardening at higher altitudes will always be a challenge, but even if annuals cannot be planted until almost mid-June, their colors are so intense their short existence is well worthwhile.

Diversified Landscape

Initially my aim was to mass perennials with splashes of annuals to give my garden areas as much color, contrast and design as possible during the average period of frost-free days. But, perhaps because of my English background, including many days in the rock garden at Kew, my thoughts turned toward the creation of a more diversified landscape to include a rock garden, a peat bed and an Asiatic primula border. These sections had to be built around some suitably placed natural boulders and, where there were changes in level, by constructing dry stone walling of native rock.

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West-facing slope with native forest in background



Sempervivums atop 10-ton boulder

Across the top of a 10-ton boulder, which had been positioned by the corner of the house during construction, were planted a mass of those oft despised sempervivums. In this inhospitable location they have produced a long lasting display of mainly pink and yellow flowers. With the high light intensity their foliage color is rewarding as well, taking on a beauty not always apparent at lower elevations.

A higher, dry wall facing northwest furnishes ideal conditions for a number of species and forms of *Lewisia*. These detest artificial watering yet love to have cool roots. Here is an example of plants that can be tricky in the extreme down on the plains, but have proven easy at my elevation. And why not? The granite walls are first cousins to their homes in the Siskiyou and Wenatchee mountains.

The primula border is nearby on the northeast side of the house, and planted there are many species from the Asiatic mountains including *Primula polyneura*, *P. waltonii*, *P. canescens*, *P. saxatilis* and the self-seeding and ever popular *P. denticulata*. A more recent addition has been *P. chungensis* which has a magnificent flower stalk up to 20 inches tall superimposed with a large cluster of fragrant orange flowers. The soil mix of three parts of the local fine soil, two parts of well-rotted horse manure, one part of granite chips (1/2 inch down), and one part peat is frozen almost continuously from October until the early part of April; yet nature does not let its plants go to sleep entirely. During the very early spring many of their foliose heads of compressed leaves poke their way up through the light mulch of pine needles.

In a similar situation, though with an hour or two more sunshine, are borders of Colorado columbines and lilies that make surprisingly complementary plantings.

Peat Bed

Another project was to create a peat bed at the base of a very large, spreading *Juniperus communis*. This is, perhaps, too large for general design, being 10 feet across; but it was naturally planted so its beauty has an intrinsic value. Here hostas, *Arctostaphylos nevadensis* and *A. patula* are being encouraged, along with the native *A. uva-ursi* growing in damper adjacent areas. In complete contrast a few feet away a planting of cholla (*Opuntia imbricata*) along with other hardy cacti is being tried as an experiment at this altitude.

The two most prominent features along my pathway through the rock garden area are the scree and the raised beds.

Raised Beds

The raised beds were constructed in order to obtain an adequate depth of soil above the underlying rock, which was scraped bare during building operations. Over the dry walls built to support these beds wooly veronica (*Veronica pectinata*) and sundry low penstemons spread their beauty. In the crevices semipervivums, a number of rock ferns, and *Telesonix jamesii* flourish according to their moisture requirements. One fern, *Woodsia oregana*, a local native, was already established and the dry walls were built up and around this to protect it in situ.

Among the plants in the beds are *Gentianodes algida*, *Gentiana acaulis*, and *G. andrewsii* along with delightful clumps of *Aethionema grandiflorum*, *Iris gracilipes*, *I. hoogiana*, sundry anemones and the spectacular *Erysimum kotschyianum*. Contrasting color is provided by the edelweiss (*Leontopodium*), spreading *Potentilla* 'Red Ace,' clumps of miniature *Iberis sempervirens* and a few artemisias such as *Artemisia genipi* and *A. stelleriana*. The period of color is extended by the bright yellow of *Doronicum columnae cordifolia* at one end of the season and the very attractive fall foliage of *Polygonum* 'Border Jewel' and *Viburnum opulus nana* at the other.

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Most of the plants have been in the garden for only a few years, just a trifle in the life of an alpine; but growth has been more than adequate. Certain items such as *Silene compacta*, *Veronica pectinata*, *Campanula cochlearifolia* and *Aquilegia saximontana* have to be thinned considerably. Trial plants for this area and elevation include various bell-flowers (*Codonopsis*), *Edrianthus serbicus*, *Armeria welwitschii*, *Potentilla megalantha*, *Dianthus gracilis* and several globe daisies (*Globularia*).

Scree Slope

On the 15 degree scree slope, overlaying the granite rock and facing almost due west, a great selection of plants such as *Saxifraga retusa* var. *angustana*, *S. caespitosa* ssp. *subgenitera*, *S. paniculata* in its various forms, *Draba olympica*, *Anacyclus depressus* and a number of androsaces including the pretty *Androsace sempervivoides* have been planted.



Raised bed with cacti at upper left

A few small shrubs, for example, *Cytisus X Kewensis*, *Cercocarpus ledifolius* and *Sibbaldia procumbens* add some height to the design. Certain plants have flourished and the clumps of *Gentiana acaulis*, *Anthemis biebersteinia*, *Armeria pseudoarmeria*, *Anacyclus depressus* and the saxifrages are almost touching each other. A very surprising plant has been *Delosperma linearis* from South Africa. This close relative of the ice plant has survived at least 30 degrees below freezing.

Watering in the scree is usually restricted to every third day (partly because of cost), but enough is applied each time to soak down to bed rock. Top growth may appear to be limited, but roots are well developed. Top dressing with a mulch of granite chips helps conserve moisture and also provides

the drainage needed to prevent any problems of water build-up which, in time, may cause damping-off and rotting of plants.

As time progresses it will be interesting to see how plants such as *Daphne X Somerset*, *Dicentra exima* and *Phuopsis stylosa* survive. It is already apparent that some of the fine New Zealand natives—*Mazus*, for one—are not hardy at sub zero temperatures. But, no matter, if necessary I can always revert back to those attractive natives growing hereabout, such as *Allium cernuum*, *Oenothera caespitosa*, *Clematis hirsutissima*, *Anemone multifida* ssp. *globosa*, *Sedum lanceolatum*, *Drymocallis fissa*, *Harbouria trachypleura* and *Mertensia lanceolata*. Perhaps, using the best of two worlds, I can hope for a happy combination. □

London's Chelsea Flower Show

Beatrice Taplin

The Chelsea Flower Show has been called "The Greatest Show on Earth" and, with all due respect to Messrs. Barnum and Bailey, it is, for any serious gardener or horticulturist, a most exciting occasion and the most comprehensive display of flowers and plants that takes place anywhere. This truly stupendous event is sponsored by the Royal Horticultural Society and takes place at the Royal Hospital, which was designed by the famous Sir Christopher Wren (St. Paul's Cathedral, Covent Garden Theatre, Hampden Court, etc.), and completed on the Chelsea bank of the Thames River in 1698.

Each May the hospital lends its grounds to the flower show, which covers 27 acres. Within days after the show has closed, the entire area is restored to pre-show conditions. Pensioners still live at the Royal Hospital and they are seen walking through the avenues, in their bright red, brass-buttoned uniforms, some heavy with campaign medals and awards.

Beatrice Taplin, a trustee of Denver Botanic Gardens and an avid gardener, chaired the committee of the Garden Club of Denver in the planning for the Home Demonstration Garden at the Gardens.

The Chelsea Flower Show was started in 1913 on 7 acres. It has become larger each year and, it is said, better, although how it could be more perfect is questionable. The show is set up as a mini-village with entrances on Royal Hospital Road and the Chelsea Embankment, with the Grand Marquee, or tent, as we shall refer to it, in the center. This enormous tent covers 3½ acres and requires two dozen men more than two weeks to install.

Inside the tent this year were approximately 115 displays of plants, flowers and vegetables. There were unbelievable delphiniums, roses, groundcovers, and clematis. There were climbing plants, rare varieties of all plants, orchids, herbs, heathers, and houseplants. There were flower arrangements. There were a scientific section and a horticulture information bureau to answer questions. The exhibits were too numerous to describe adequately.

The Blackmore and Langdon display of delphiniums, including 'Icecap', a tall white and 'Sungbeam', a creamy-yellow, was breathtaking. The Hillier Nursery exhibit consisted of one hundred plants—The Hillier 100—to celebrate

Sir Harold Hillier's knighthood, bestowed this year, and the first to a British nurseryman. Two amazing clematis displays, including that of the Treasures of Tanbury Nursery showed 2000 clematis plants in 75 varieties.

Outstanding was an exhibit by Beth Chatto's Gardens, which displayed a lovely variety of plants that were divided into sun and shade lovers. Besides being a helpful garden, it was an enchanting work of art. Here, as in many of the other exhibits, were some of the true blue perennials that are still hard to find, such as *Gentiana acaulis* L., *G. asclepiadea* L., *G. septemfida* Pall., *Meconopsis betonicifolia* Franch., *Geranium* 'Johnson's Blue', and *Penstemon heterophyllus* Lindl.

Surrounding this enormous tent are avenues and roads for booths where distributors of gardening accessories show their products and take orders. There are tractors, sprayers, vases, seeds, books, chemicals, and large sections of greenhouses and garden furniture. Here, too, is a snack bar, and yes, a bank!

Particularly interesting outside the tent, and a major part of the show, are the gardens which have been designed by landscape designers, some well known, and others winners of competitions sponsored by such important media as the *Sunday Times* and the *Daily Telegraph*.

The *Sunday Times* entry was called a Perspective Garden, a design that used optical illusion and trickery to persuade the eye that the layout consisted of circles although actually arcs and half-circles. The boundaries were blurred by vegetation and a pond strategically placed to draw attention to the end of the garden through a path of diminishing width. All these innovative uses of eye-catching materials and structures made a wonderful setting.

The *Daily Telegraph* sponsored two entries—a town garden and a country garden. These prize-winning exhibits were both designed by young women landscape designers, one of whom is 26 years of age! Included was a fruit garden, a rock and water garden, and a Japanese garden.



Judges at the Halifax Cottage Garden



Paul Temple Japanese Garden

The Halifax Building Society aimed to demonstrate a true cottage garden and to show that such is relevant and achievable in the '80s. Cottage gardens were created not by owners of large estates but usually by artisans, smallholders, and village craftsmen and their families. The '83 Halifax garden at Chelsea was incredibly charming. It included, among many other materials, the beautiful and familiar *Rosa banksiae* Ait., *Rosa damascena* Mill. (the York and Lancaster rose—for the English history buffs), buddleia, hypericum, clematis, lupines, verbascum and many of our other favorite perennials and annuals.

To top everything, literally and figuratively, the beautiful *Aesculus hippocastanum* L.—the pink and white flowered varieties of horse-chestnut trees of London were in full bloom. Although it had rained in London for 31 days, the show opened with overcast but dry skies. This visitor attended the Chelsea Show four of the five days during

the week. On Monday, the traditional press day, judging day, and visit of the Royal Family, the avenues were lined with trucks bringing supplies to the displays. The overcast skies didn't at all cloud the air of anticipation and excitement as booths were completed, the gong rang, and the trucks disappeared. The judges, making their rounds to decide upon recipients for the coveted awards, were dignified and obviously knowledgeable. British discretion always prevails, and the designers and growers were keeping their distances while the judges inspected their areas. In the tent last-minute touches were added to displays. One wouldn't have thought that anything could be more perfect, until, voilà—there was added another lovely specimen in the perfect spot.

On Tuesday, Fellows day, at 7:30 a.m., the crowd had started to grow along the surrounding streets. The air of expectancy and the courtesy of those in line really made one feel part of the show. As the crowd (the

Fellows, 75,000+ are members of the Royal Horticultural Society) entered the show, individuals headed for their favorite areas to see “what could be better and new this year,” and no one seemed disappointed. On Wednesday, the first day that the show was open to the public crowds were enormous, and by Friday it was very crowded, but still, with patience, possible to see the displays. Friday afternoon at 4 o’clock, the crowds began to polarize, people gathered around their favorite displays, so that when the closing gong rang at 5 o’clock they would be close to their favorite flowers and plants, most of which were for sale. There was no pushing or grabbing; one waited one’s turn and asked for one’s choice. Visitors were of all ages, sizes, colors and styles—some with carts, and all with bags, to carry home their treasures. The ambiance at the closing was exhilarating, with “what a day!” and “we did it again” pride.

On Tuesday through Friday the band of the Grenadier Guards presented seven concerts; each program included exactly 14 pieces—mostly pop music, but everything from the “Magic Flute” overture and Strauss waltzes, to a “George Gershwin Portrait” and a “Lennon McCartney Portrait.” To hear those sounds and see the garden and flower displays and look up at the beautiful horsechestnut trees is a heady experience.

One should also visit the Chelsea Physic Garden—two blocks to the east of the Royal Hospital. This garden, established in 1673 and one

of the oldest botanical gardens in the world, is a four acre oasis of historical gardening interest. Many of the plants thrive here because the garden is so sheltered from the wind and borders a wide expanse of the Thames, which mitigates frost. The Chelsea Physic Garden has just this year been opened to the public.

A visit to the Chelsea Flower Show warrants a trip to London. You’ll see the old familiar plants, as well as new varieties. It is the traditional time to introduce new roses. This year, among others, was ‘Sadler’s Wells’ from Peter Beales Roses (Mr. Beales loves ballet)—a continuously flowering shrub rose of silvery pink to cherry red which blooms particularly well in autumn. Two other new roses, from David Austin Roses, were ‘Mary Rose,’ with full-petaled rose-pink flowers, and ‘Graham Thomas,’ a strongly scented rose with true yellow cupped flowers which Austin’s feels is the best rose it has ever developed.

You’ll see lovely gardens that have been designed with usual and unusual plans, and filled with the most extraordinary variety of planting materials. You will be eager to get home to try new plants and plans.

But above all, you’ll see those wonderful British faces (and their often funny hats) and you’ll be as proud as they of the Chelsea Flower Show because you are so aware that it represents their knowledge, diligence, and care. During this week in London everyone is on a high and as the Londoners say, “All roads lead to Chelsea!” □

De Boer Remembered

Janis Falkenberg

The papers that a man leaves behind him can reflect his life; those who come after may see that life in the mirror of the manuscripts. Occasionally, the mirror fails us: a cracked piece is missing, or the silvering has flaked away, leaving a reflection blurred or faint. But a careful study of the manuscript collection reflects to us the shape of a man's ideas and accomplishments, and so it is with the papers of S.R. DeBoer.

Through the generosity of his family, Mr. DeBoer's papers are now part of the Manuscripts Collection of the Western History Department of the Denver Public Library. Occupying more than 30 cubic feet of storage space, the DeBoer papers contain drawings and plans, photographs, office files, some biographical material, and manuscripts and publications. They have been cleaned and flattened, organized and inventoried, and formed the basis for a recent exhibit displayed in the Western Room. The Manuscripts Collection is now available to researchers interested in the history of Denver's parks and gardens.

Janis Falkenberg received her M. A. in Librarianship from the University of Denver, where she specialized in historical manuscripts and archives. As a freelance archivist, she processed the S. R. DeBoer Papers under a contract with the Denver Public Library.

The chronological structure of S.R. DeBoer's life is apparent in his autobiography, a special issue of *The Green Thumb* magazine published in 1972.

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He was born in 1883 in the province of Freisland, The Netherlands, and went to school near his home. His father was an architect, and it was with hopes of becoming an engineer that S.R. studied for a time at a Dutch engineering institute. Ill health forced him to return home, where he studied privately and received government certification as a surveyor.

DeBoer's interest turned to landscape design, and he pursued both formal and independent study of plants, and of design. He went to Germany to attend the Royal Imperial School of Horticulture; once again illness forced his return home, where he studied on his own. Briefly, he opened a private landscape office but in 1908 the lung disease recurred, and the DeBoers decided the dry climate of the American West would offer hope and health. His brother took him to Rotterdam, and S.R. sailed away to a new life.

After a brief stay in New Mexico—DeBoer says he was never sick after he came to the United States—he settled in Denver, and went to work as a surveyor and draftsman for an

irrigation company. This company sent him to work in Canon City; when they went out of business DeBoer returned to Denver: his home for the rest of his life.

After initial employment as a rose grafter, in 1910 S.R. DeBoer soon was hired by the Denver Parks Department, first as a teamster in the City Nursery at 9th and York. Park superintendent Frederick Steinhauer asked the new employee to plan a park for 8th and Speer, and DeBoer's drawing of The Sunken Gardens was the beginning of a lifetime of planning and planting for the city of Denver. He worked for the city in various capacities until 1958: nearly fifty years of devotion to the improvement of his city.

In 1919, DeBoer opened a private landscape office with M. Walter Pesman, a partnership that lasted five years. He maintained a private office throughout his life, designing residential gardens and making city planning studies for towns throughout the west, as he continued his work for the city of Denver.

The logo of the Library's DeBoer project, a book plate designed for Mr. DeBoer by Frances White Novitt, depicts his office at 515 E. Iliff, and was one building of a group of buildings that included also his home. In 1910 S.R. married a fellow-Hollander, Anna Sophie Elizabeth Koster, and they raised a son and daughter.

Saco Rienk DeBoer died in Denver in 1974.

Thus the bare outline of a life. The picture provided by the papers, however, is a varied and colorful one. From 1910 until 1974, S.R. DeBoer thought about, and planned for, a more beautiful Denver. It was



Saco Rienk DeBoer

his good fortune to work in the Speer administrations, and in this mayor, DeBoer found more than an ally in the development of parks.

Mayor Speer was dedicated to the principles of The City Beautiful movement, and his purposes included the Civic Center, channeling and planting along Cherry Creek, and well planted parkways as part of the city's street system. The drawings in the DeBoer Collection reflect the busy Speer years, and include several plans for Civic Center, planting along Speer Boulevard, Berkeley Park, Inspiration Point, Federal Boulevard, and the parkways on Marion Street, and Sixth, Seventh, and 17th Avenues.

Mr. DeBoer said he did not create Denver's parks, but that he improved them. City, Washington and Cheesman parks had been designed, and some planting was accomplished before DeBoer began working for the city. He re-routed the roadways in City Park and Cheesman, and planted the ever-green forest at the north end of Washington Park. He also designed the Mt. Vernon flower garden and perennial beds for Washington Park; the design of the beds along

South Downing has since been changed, but the Mt. Vernon garden retains its original shape and essentially the same planting. The blueprint of the planting diagram for the perennial beds is wrinkled and ragged—showing evidence of having been used on the job.

The DeBoer designs for his first city park, the Sunken Gardens, exist in the collection in several forms. The earliest photographs of the accomplished beds show graceful arabesques of flowers bordered by low hedges; a later scheme includes the words “Sunken Gardens” planted in flowers. At the north end of the Gardens, DeBoer built a small rockery and waterfall, an element he was to repeat often in the years to come.

Park planning continued in the 20s and 30s and the end of Speer Boulevard was marked by DeBoer’s plans for Alamo Placita and

Arlington (now Hungarian Freedom Park). The fountain and sculpture in Arlington are recent additions, but the grove of evergreens at the east end is clearly shown on DeBoer’s plan. The flower beds at Alamo Placita have been re-designed; trees and the playground are little changed. DeBoer had a strong belief that parks were for people, and his designs consistently include play and art centers, bathing beaches and skating ponds. Grassy depressions that show on the plans as playing fields or bowling greens are often noted to be flooded in the winter for skating: an expected pre-occupation for a Netherlander.

During the Stapleton administration DeBoer planned an ambitious extension of the parkway scheme. North Denver was to have connections among Barnum, Sloan Lake, Berkeley and Rocky Mountain Parks; the whole was to be linked to the east and south parts of town

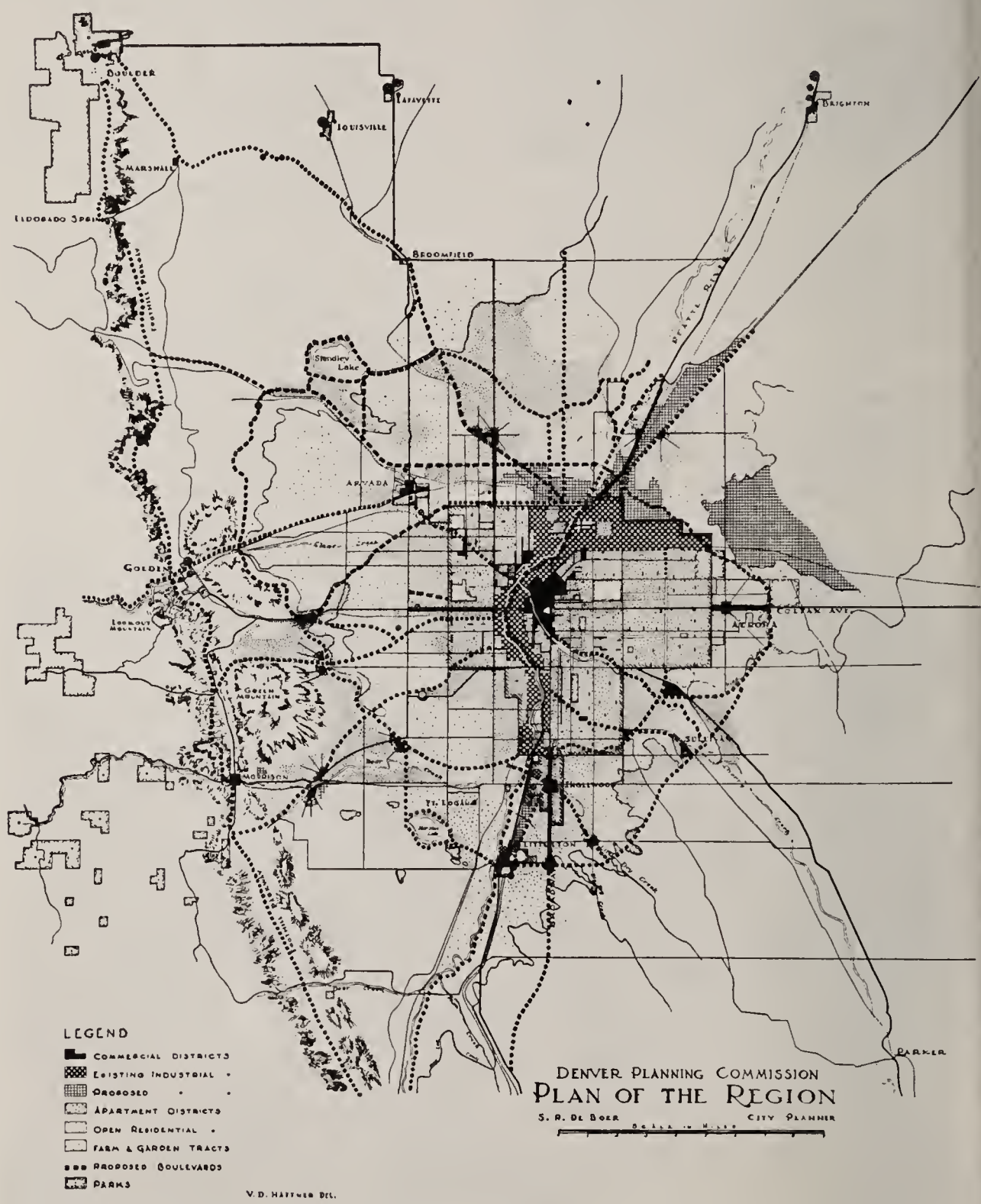


Waterfall in Sunken Gardens Park: Installed by DeBoer in 1915

through Montclair and along the South Platte. Political realities intervened, and these plans remained unrealized.

The collection shows drawings for the Municipal Airport during the 20s, wonderful scenes of a tiny, almost insignificant place. DeBoer

clearly saw it as an area to be beautified, and gave thought as well to its appearance from the air; one plan has “Denver” worked out in flowers. But the best of all shows flower beds planted in the shape of an airliner, including of course, the propeller.



First published in 1933 in *The Denver Plan V.4: Preliminary Outline for a Region Plan*, Denver Planning Commission

The City of Denver appointed a Planning Commission in the late 20s, and S.R. DeBoer was one of its consultants for many years. The collection includes a large number of planning studies done for the Planning Office: information was gathered primarily on traffic patterns and problems, but also compiled were statistics on population, health, economic growth, recreation opportunities, etc. The office published several booklets on planning in Denver, and DeBoer wrote portions of several of them.

S.R. DeBoer took a plantsman's interest in what trees and shrubs were hardy in this climate, and believed strongly that nurserymen, and the public, needed education in what to grow. He gave many hours to the idea of a botanic garden for Denver, and the collection offers several examples of his interest. Pages of notes on how, and why, and where such a garden should be built lead finally to a DeBoer plan worked out for Denver's first Botanic Garden which was planted just west of the Museum of Natural History in City Park. The roses, the evergreen garden and the lilies all were planted, along with a rock garden and water course; these gardens could not be properly protected within the open park, so Denver Botanic Gardens moved south and west to a new, and its present, location.

DeBoer's design and consultation work for the City of Denver continued into the 50s. He was active in the controversy over the location of I-70 through the city, and he had plans for Harvard Gulch and the South Platte. His interests always went beyond trees and parks: he saw the need for regional plans, mass transportation, the planting of waterways to minimize flood damage. In 1962 the City

Council recognized Denver's debt to its park man in naming a small spot near Harvard and S. Vine, DeBoer Park.

During the years he worked for the city, DeBoer was simultaneously carrying on an active planning and landscape design practice. His papers reflect his work in hundreds of measured drawings and photographs, the narrative portions of city plans, and schemes for regional developments and residential areas.

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What image does the collection give us of DeBoer the planner? Outside of Denver, his first major effort was for Grand Junction, Colorado; the result was a 3-volume comprehensive plan based on careful study of a wide economic area. The papers teem with park studies, recreation plans, zoning ordinances, development plans, etc. for cities all over the west. DeBoer made a design for the Saratoga Springs resort in Wyoming, planned a residential development for Estes Park's Stanley Corporation, and worked for cities in Idaho, Minnesota, and Nebraska.

Through the depression years of the 30s one of the federal government's activities was state and regional planning, organized through the National Resources Planning Board. S.R. DeBoer was consultant to this board for Utah, New Mexico and Wyoming. He traveled extensively throughout these states, participating in the studies done on population, water development, public lands and their uses: what were the natural resources and human needs of the three states? The results of this work appear in the collection as a large number of reports and recommendation documents—all bearing S.R. DeBoer's name.



Speer Boulevard ca. 1910

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The biggest single item in the collection is a 6' by 8' drawing for a brand new town: Boulder City, Nevada, and DeBoer always believed this plan to be one of his best. At the time Boulder (that is, Hoover) Dam was built, DeBoer was engaged by the Bureau of Reclamation to design the neighboring town, and the three-volume plan, with photographs of alternative sites, is one of the treasures of the collection. Today maps of Boulder City show the basic triangular layout of DeBoer's design, although he was disappointed to see the city grow up in some ways that were not part of his plan. Boulder City remained in DeBoer's life, as it remains in the collection, a high point.

The domestic gardens designed by S.R. DeBoer appear in the collection in several forms. There are a few presentation drawings, some hand-colored, but predominately the plans have been photostated and sharply reduced. The purposes of his garden plans are, however, quite clear.

Generally, whether the space is a small city building site or a suburban estate garden, the design includes a combination of formal and natural elements. In any garden affording interesting views, notations are on the plan as to which peak or creek was visible in a

particular direction, with the planting arranged not to interfere. Grape arbors are common; vegetable plots are often included. One of DeBoer's most unusual residential gardens included a swimming pool built to resemble the 'ol swimmin' hole' of the owner's midwestern youth. And some of the gardens reach beyond the grave: the collection contains two landscape designs for large cemetery plots.

S.R. DeBoer did more than study cities and their needs, more than think about gardens and planting. He wrote about what he believed, tirelessly, and at length. In another than his native language, he took notes on what interested him, wrote reports and articles and letters to the editor, published two books and prepared a third in manuscript. And, apparently he had time to spare because he wrote fiction: short stories, which are in the collection, but seem never to have been published. He even attempted to cast a planning document in fictional form, writing a story about how an airport might change the lives of the citizens. All these are in the collection and provide windows on a man and a mind.

A person sowing a seed or transplanting a tree is surely an optimist. S.R. DeBoer was that and more: a reformer whose optimism included a belief that parks, trees, gardens would lead to human happiness. Denver is a happier place because of Saco Rienk DeBoer. □

A booklet entitled *S.R. DeBoer* and published to accompany the DeBoer exhibit, a part of the "Parks and Open Spaces: a Denver Perspective" program, includes additional information about and tributes to DeBoer as well as many fine illustrations. Copies are available for \$1.00 plus 50¢ for postage from the Western History Department of the Denver Public Library, 1357 Broadway 80203. Editor.

Patricia Pachuta— Horticultural Education Specialist

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Appointed to the newly designated position of Horticulture Education Specialist in March, 1983, Patricia Pachuta is directing the education program of Denver Botanic Gardens. She comes to us with an impressive background in the educational aspects of a botanical garden.

Formerly with Matthaei Botanical Gardens of the University of Michigan in Ann Arbor, Ms. Pachuta was responsible for coordinating all growing operations there. She was also involved with staff training, designing and implementing educational displays, and in public relations and fund raising activities for the Gardens. Working closely with Friends of the Matthaei Botanical Gardens, she provided horticultural and botanical expertise to volunteers and presented demonstrations and workshops for the Friends on a number of subjects.

In addition to instructing summer interns, Ms. Pachuta taught for the University Center for Adult Education. She also familiarized faculty and graduate students with the conservatory plant collections to better enable them to utilize those plants in their courses and research.

Publications to her credit include "Guide to Selected Medicinal Herbs," coauthored with Jane I. LaRue, June 1979, and "The Economic Uses of Succulents," March 1976, in *Bartlettia—Notes from the Matthaei Botanical Gardens*. She also edited the newsletter of the Michigan Botanical Club.

Graduated from Colorado State University with a B. S. degree in landscape horticulture, Ms. Pachuta has continued her education in the field of botany through graduate level courses taken while she was at the University of Michigan.

New momentum and direction in the educational program are anticipated with the appointment of Patricia Pachuta to the staff at Denver Botanic Gardens.

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The Council on Botanical and Horticultural Libraries

Solange Gignac

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The Council on Botanical and Horticultural Libraries, Inc. was formally organized in April 1970. The purpose of this organization is to initiate and improve communication between persons and institutions concerned with the development, maintenance, and use of libraries of botanical and horticultural literature.

The group recently held its 15th annual meeting hosted by the Cherokee Garden Library, Atlanta Historical Society, Atlanta, Georgia. In past years, conferences have been held in Boston, Chicago, Cleveland, Denver, New York, St. Louis, San Francisco and Washington, D. C. At each of these conferences the attendance varies, but representatives from all institutional libraries who can attend, do. The membership to CBHL is not limited to librarians but is open to interested persons from the horticultural and botanical professions and others. The group does include many librarians, but there are members who are collectors, book dealers, professors, historians.

The meeting in Atlanta was rich in its local flavor as have been the others. A reflection of the host institution is a most visible facet of any conference. Each has its unique setting and flavor.

Solange Gignac, librarian, Helen Fowler Library of Denver Botanic Gardens, is immediate past president of CBHL.

None of the meetings could be called typical because the host institution as well as the setting are different each time. In Atlanta we were hosted by the members of the Cherokee Garden Library which is housed in the Atlanta Historical Society complex. Southern hospitality abounded. We were warmly greeted, feted, wine and dined. The generosity of the hosting group extended itself to a dinner at a private home; to being driven in private cars to and from the grounds of the Atlanta Historical Society; to being shown private gardens; to being served dinner at the Piedmont Driving Club after having attended a party hosted by the Atlanta Botanical Garden at its location.

So much for the entertainment part of the conference. The substance consisted of the exploration of the theme "The Role of Literature in Garden Restoration." This was accomplished in two days of illustrated lectures, an opportunity to study the prize winning display entitled "Land of Our Own: Landscape & Gardening Tradition in Georgia, 1733-1983;" a panel discussion on the theme and a business meeting of the membership.

In 1980, the group met in New York, hosted by The New York Botanical Garden Library. The feature of this conference centered on the preservation of library

materials. Not only were we shown how best to protect books and pamphlets from deterioration, but we had hands-on projects directed by the conservation staff of The NYBG. We were divided into small groups so that individual participation was possible. The information verbally and physically presented was also available to us in hard copy so that we brought home exact instructions, not having to rely on memory. Hedi Kyle, head conservator at The NYBG has recently written a book in collaboration with three other members of the Guild of Book Workers. Entitled *Library Materials Preservation Manual, Practical Methods for Preserving Books, Pamphlets and Other Printed Materials*, this well illustrated volume will serve as a resource for materials maintenance.

The CBHL participants were indeed fortunate to experience this workshop from such authoritative personnel.

Past conferences have concentrated on the resources of a particular area. The 1981 conference in Washington, D. C. showed us the exceptional wealth of material at the Library of Congress, Dumbarton Oaks, the Smithsonian Institution and at the National Library. Such giants are not equalled in any area of the country but their treasures are available to us through inter-library loan, access to data bases and through personal contact.

The most beneficial feature for CBHL members is the opportunity to become acquainted with all members of the group. Not only is it important but convenient as well to be able to call the library at Strybing Arboretum and ask for the librarian by name and realize that she will respond personally to the caller at the other end of the line. A

particular need for information recently arose at the Helen Fowler Library when a staff member wanted a copy of an issue of the *Journal of the California Horticultural Society*. He actually had a copy but it was virtually unreadable. No indication was given as to volume number, issue number and date. One cannot send an inter-library loan request with such a paucity of information. But one can call a friend who happens to be the librarian at Strybing Arboretum and ask for help. The assistance was given with accuracy and generosity. A copy of the entire issue of the periodical was in my hands within two days, thanks to Jane Gates and the CBHL liaison.

During any year, eight to twelve lists of duplicate periodicals and books are offered to all the members of CBHL, a most tangible benefit. Once a list arrives, it is very wise to drop everything, search the catalog, mark those books or periodicals desired and mail back to the offering institution as soon as possible. Prices are very reasonable, and these duplicate lists are very often the best inexpensive sources of rare out-of-print material. Mention should be made that the lists are compiled by the institution wishing to dispose of duplicate material, sent to The New York Botanical Garden where they are reproduced and distributed to the membership.

All the conferences are special. Each allows the participants entrance to doors that would otherwise not be open. Friendships have been made, nurtured and renewed at the annual meetings. One cannot return to one's library after attending a meeting without increased knowledge and renewed enthusiasm for one's work. □

Nolina Rediscovered in Colorado—But Which Species?

William G. Gambill, Jr.
William F. Jennings

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In a recent article in *The Green Thumb* William F. Jennings (1983: 159-161) made an interesting prediction that *Nolina microcarpa* Wats. would be found again in Colorado and published two recent photographs which he had taken of the plant in central Arizona, in flower. This plant, locally known as beargrass (not to be confused with *Xerophyllum tenax* (Pursh) Nutt.) of northwestern U. S.) is now placed in the agave family (*Agavaceae*).

It was first collected in Colorado 103 years ago north of Trinidad by the eminent botanist and plant explorer Edward L. Greene. The plant has not been reported from Colorado since then, and Greene's specimen, now in the Gray Herbarium of Harvard University, is the only known collection from Colorado up to this time. This plant was named *Nolina greenei* by Sereno Watson at Harvard, and is the type specimen of that species. Jennings' prognostication was based also on the fact that the plant occurs in northern New Mexico not far from the Colorado line, and in the Oklahoma panhandle. He

suggested looking for it in Las Animas and Baca counties in Colorado.

Excited by the prospect of finding the plant again a group including Jennings, William G. Gambill, Lucian Long and Alice Wood set out to search for beargrass in southern Colorado. After a day of fruitless hunting north of Trinidad, the group enlisted the assistance of Willard Loudon, a trustee of the Colorado Chapter of The Nature Conservancy and co-owner of the Loudon Land and Cattle Co. Ranch (ca. 32,000 acres) in Las Animas County. He was asked for suggestions and directions to botanically interesting localities in the Mesa de Maya area. A lifelong resident of southern Colorado and acquainted with the flora, Loudon knew that a plant called beargrass by the local residents occurred in a remote area of his ranch. After ascertaining that the plant being sought was probably the one he knew, Loudon led the group on June 16, 1983 to a large colony of beargrass.

Perhaps 200, or more, of the plants were growing at this site on a steep, rocky, dry south-facing slope of the Mesa de Maya. The area is one in which pinyon, scrub-oak, juniper, prickly pear and yucca abound, but the slope on which the beargrass was growing had relatively few trees. Clumps of the plant,

William G. Gambill, Jr., Ph.D., Director Emeritus of Denver Botanic Gardens, is a former professor in botany and taxonomy at Ohio University at Athens.

William F. Jennings, professional engineer and serious botany hobbyist, has a keen interest in wildflowers of Colorado and adjacent areas.

looking like coarse grass plants, were scattered over the hillside, and it was noted that they frequently grew from under the edges of large rocks where protection, moisture and temperature may favor them. The site is located about 50 miles east of Trinidad in Las Animas County, approximately 5 miles north of the Colorado-New Mexico line, 18 miles east of Branson and 17 miles southwest of Kim. Quite clearly this was not the type locality from which E. L. Greene collected his specimen(s), but a new location. Specimens were collected which will be deposited in the Kathryn Kalmbach Herbarium (Denver Botanic Gardens) and other appropriate herbaria. This *Nolina* probably reaches the northern-most point of its North American distribution in southern Colorado.



Gambill and Jennings at *Nolina* site

Leaves of the plants observed at the Mesa de Maya site are yucca-like in appearance, evergreen, stiff, slender, finely striated, and tapering to a point that splits allowing fibers (vascular bundles) to become free and much-curved for as much as 10 cm beyond the leaf blade. The margins of the leaves are completely smooth and entire, without any sign of serrations. These leaves average

45-47 cm in length above the ground level, and vary in width from 3-4 mm at the base to 2 mm at the tip where they become fibrous-lacerate. They are relatively thick and channeled or concave on the upper side and convex on the lower side. There is no above-ground stem, the leaves springing in dense clusters from a thick, woody caudex.

The plants observed at the Mesa de Maya had already flowered by June 16, apparently during early June or late May. A pale, yellowish-white, spent inflorescence was collected from one plant, the stalk being about 60 cm in height, the primary branches reaching 15 cm at the base of the compound panicle, and tapering upward to a length of 5-6 cm near the tip of the stalk. The primary branches were subtended by very conspicuous lanceolate bracts varying in length from 12 cm at the base to 4 cm at the tip of the stalk. This stalk appeared to bear only staminate flowers, the dried, whitish perianth segments and stamens still remaining. The flowers are tiny, 2-4 mm in diameter, both unisexual and bisexual types occur, sometimes on the same plant, but the sexes are mostly on separate plants.

A blackish, spent inflorescence from a previous year was collected which measured 50 cm in height with long conspicuous paniculate bracts, some measuring 40-45 cm in length. This inflorescence still bore numerous black, dried fruits, some containing dried rounded seeds 2-3 mm in diameter. This was obviously a pistillate inflorescence, and it scarcely reached the tips of the leaves of the plant on which it grew, while the whitish, staminate inflorescence extended 10-15 cm beyond the tips of the leaves.

Attempting to place a Latin name on these plants has left the writers in a quandary. Although both Harrington and Weber refer to the plant which E. L. Greene collected in Colorado in 1880 as *Nolina microcarpa* Wats., and place Watson's name, *Nolina greenei* in synonymy, as do Benson and Darrow, it is doubtful whether the Mesa de Maya plants truly represent *N. microcarpa*. The descriptions of *N. microcarpa* by Cronquist et al., by Rickett, and by Benson and Darrow all refer to the inflorescence as standing 1-2 m above the ground. This is definitely not true of the plants observed at Mesa de Maya. Further, Cronquist et al., Benson and Darrow, Wooton and Standley, Martin and Hutchins, all characterize the leaf margins of *N. microcarpa* as scabrous to strongly serrulate. The leaf margins on plants at Mesa de Maya were completely entire and smooth.

The plants do appear to resemble the *Nolina erumpens* (Torr.) Wats. described by Wauer from Big Bend National Park in Texas by having leaves which are not toothed, and inflorescences which are seldom more than a foot or two above the leaves. It is of interest to note that E. L. Greene himself recognized the similarity of the plants he saw to *N. erumpens* and so stated in his transmittal letter to Watson in 1880. He wrote: "The scapes lack six or eight inches of being as long as the leaves. I suppose it is a dwarfed condition of your *N. erumpens*, but I wish to know what you find it to be."

However, according to Correll and Johnston, leaves of *N. erumpens* are serrulate contradicting the statement by Wauer. Martin and Hutchins place *Nolina greenei* in

synonymy under *Nolina texana* Wats. The fact that there are so few herbarium specimens bearing the name *N. greenei* points to the extreme shortage of specimens for botanists to study, and helps to explain the lack of agreement as to what should be done with *N. greenei*. Clearly, further research will be required to determine the correct botanical affinities of the Colorado plants. In the meantime, the rediscovery of these plants should be most helpful in solving the problem. □

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The Green Thumb



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Vol. Forty
Number Four



The Cover

Christmas Rose

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The Green Thumb

Winter 1983

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Velma A. Richards
Editor

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Denver Botanic Gardens, Inc., maintains a collection of living plants, both native and exotic, for the purpose of acquiring, advancing, and spreading botanical and horticultural knowledge.

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Chatfield Arboretum— A Visible Beginning

Charles Paxton

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Another summer past. With an upslope that caused the winds to change directions as though frantic to find refuge from three nights of hard freeze, summer is over and autumn begins. At a season's end it seems fitting to reflect on our accomplishments and to announce a beginning. With the start of three major projects and the planting of several hundred trees and shrubs, the Chatfield Arboretum has begun.

Between gusts of wind and snow storms the first plantings were done in early March. It is a shelter belt built to protect the nursery area from future storms. The nursery area also received more than 200 plants to be held for permanent locations yet to be chosen. Many of these plants have been kept at the Gardens on York Street waiting for this event for almost as long as the Arboretum has been in concept. For the most part, they seem to appreciate the deep, rich soils here after a long wait in cramped pots.

April and May came and our planting continued, as did the snow. Our attention was now drawn to the second project—that of landscaping around the Visitor Center and the picnic area.

Charles Paxton, grounds superintendent of Chatfield Arboretum since June 1981, is a graduate in nursery and landscape management from Colorado State University at Fort Collins.

Two years ago the Visitor Center, a historic one-room schoolhouse, was restored; and picnic tables were scattered in the adjoining field of thistles. The challenge here was to create a suitable landscape for the building and to civilize the rougher edges of the area.

Setting out with a water-soaked plan and high rubber boots, we planted our first oak in the center of the picnic area. After sloshing back a few steps, we were heartened by the immensity of the act just completed. We shared a few kind thoughts for Katharine Bruderlin Crisp, that little teacher whose great love of trees prompted her many former students and friends, members of Around the Seasons Club, to donate in her memory to make this planting possible. It seems it was acceptable; it started to snow again, and summer gave three flushes of growth on that particular oak.

By late June temperatures were too hot for planting, which was just as well because we had nothing left to plant. We had anticipated just such a change of season and really wanted to get started on our third project—building trails for the Kim Sterne Survival Garden.

The Survival Garden is situated in a wide portion of the riparian sector. Separated from the picnic area by

Deer Creek, it includes a wide diversity of dense vegetation. The plan called for construction of paths winding through a variety of existing vegetation and contacting a maximum number of micro-climates available within the Garden. To reach the high creek bank and the much drier area above, a curving stairway was constructed leading to the future pond site for aquatic plants and an area to be bermed and used for dry-land species.

With the growing season at an end, we still look for progress on other projects. With the help of the Seabees, we will build a bridge to cross Deer Creek. The Men's Garden Club of Littleton will build a picket fence to frame the Visitor

Center and enhance the landscaping. Reroofing the future administration buildings is also planned for this year.

When these scheduled projects have been completed, winter will have settled in to allow us time for planning next season's activities.

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We have only 16 more winters in which to plan our summer projects, if we stay with our master plan. We finally have a beginning with something visible, but winters can be too short if we only reflect on small accomplishments. There is much more to do to complete our plantings, restore our buildings, and establish our educational programs at Chatfield Arboretum. □



New plantings at the Visitor Center—a restored one-room schoolhouse built in 1886



Picnic area at Chatfield Arboretum

Species planted in picnic and Visitor Center areas.

Native plants around the Visitor Center.

<i>Acer grandidentatum</i> Nutt.	Bigtooth Maple
<i>Agropyron smithii</i> Rydb.	Western Wheat-grass
<i>Alnus tenuifolia</i> Nutt.	Alder
<i>Holodiscus dumosus</i> (Nutt.) Heller	Ocean Spray
<i>Mahonia repens</i> (Lindl.) G. Don	Oregon-grape
<i>Potentilla fruticosa</i> L. cv. Jackman	Shrubby Cinquefoil
<i>Physocarpus monogynus</i> (Torr.) Coult.	Ninebark
<i>Populus sargentii</i> Dode	Plains Cottonwood
<i>Quercus gambellii</i> Nutt.	Gambel's Oak

Windbreak for the picnic area

<i>Abies concolor</i> (G. & G.) Lindl.	White Fir
<i>Picea pungens</i> Engelm.	Colorado Blue Spruce
<i>Pinus flexilis</i> James	Limber Pine
<i>Pinus ponderosa</i> Laws.	Yellow Pine
<i>Pinus strobiformis</i> Engelm.	
<i>Pseudotsuga menziesii</i> (Mirb.) Franco	Douglasfir

Oak grove in the picnic area.

<i>Quercus alba</i> L.	White Oak
<i>Quercus bicolor</i> Willd.	Swamp White Oak
<i>Quercus macrocarpa</i> Michx.	Bur Oak
<i>Quercus mongolica</i> Fisch. ex Turez.	Mongolian Oak
<i>Quercus robur</i> L.	English Oak
<i>Quercus velutina</i> Lam.	Black Oak

Oak hybrids from the State Arboretum of Utah.

Checklist of the Vascular Plants of the Chatfield Arboretum Site

Janet L. Wingate

The Chatfield Arboretum site of the Denver Botanic Gardens comprises 350 acres in southern Jefferson County. Most of the area is disturbed or under cultivation, but a more native vegetation can be found along Deer Creek and along the southern border of the property. *Ribes americanum*, an endangered species, was found in the southern area.

This checklist includes only native or naturalized plants; cultivated plants have not been included. A total of 325 species were found: 214 indigenous, 108 adventive, and 3 uncertain. Voucher herbarium specimens for each species were collected and have been placed in the Kathryn Kalmbach Herbarium, Denver Botanic Gardens. The field work for this project was done during the growing seasons of 1981, 1982, and 1983.

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Subdivision: ANGIOSPERMAE Flowering Plants

Class: DICOTYLEDONEAE Dicots

ACERACEAE Maple Family

Acer negundo L.

var. *interius* (Britt.) Sarg.

Box-Elder

Ind.

AMARANTHACEAE Amaranth Family

Amaranthus graecizans L.

Prostrate Pigweed

Adv.

A. retroflexus L.

Rough Pigweed

Adv.

ANACARDIACEAE Sumac Family

Rhus trilobata Nutt.

Skunkbrush

Ind.

Toxicodendron rydbergii (Small) Greene

Poison Ivy

Ind.

APOCYNACEAE Dogbane Family

Apocynum sibiricum Jacq.

Siberian Dogbane

Adv.

ASCLEPIDACEAE Milkweed Family

Asclepias incarnata L.

Milkweed

Ind.

A. pumila (Gray) Vail

Low Milkweed

Ind.

A. speciosa Torr.

Showy Milkweed

Ind.

BORAGINACEAE Borage Family

Asperugo procumbens L.

Madwort

Adv.

Mertensia lanceolata (Pursh) A. DC.

Narrow-leaved Mertensia

Ind.

Onosmodium molle Michx.

False Gromwell

Ind.

var. *occidentale* (Mack.) Johnston

CACTACEAE Cactus Family

Opuntia compressa (Salisb.) Macbr.

Prickly-pear

Ind.

O. polyacantha Haw.

Starvation Cactus

Ind.

CAMPANULACEAE Bellflower

Triodanis perfoliata (L.) Nieuwl.

Venus Looking-glass

Adv.

CANNABINACEAE Hemp Family

Cannabis sativa L.

True Hemp

Adv.

CAPRIFOLIACEAE Honeysuckle Family

Symphoricarpos occidentalis Hook.

Snowberry

Ind.

CARYOPHYLLACEAE Pink Family

Cerastium fontanum Baumg.

Mouse-ear

Adv.

Dianthus armeria L.

Pink

Adv.

Gypsophila paniculata L.

Baby's Breath

Adv.

Melandrium dioicum (L.) Coss. & Germ.

White Campion

Adv.

Saponaria officinalis L.

Bouncing Bet

Adv.

Silene noctiflora L.

Night-flowering Catchfly

Adv.

S. vulgaris (Moensh) Garcke

Catchfly

Adv.

Janet L. Wingate, Ph.D., in addition to her study of the existing flora at the Chatfield Arboretum site, is doing a verification study

of all the cultivated plants at Denver Botanic Gardens' York Street site.

<i>Liatris punctata</i> Hook.	Blazing Star	Ind.
<i>Machaeranthera pattersonii</i> (Gray) Greene	Tansy-aster	Ind.
<i>M. pinnatifida</i> (Hook.) Shinnery	Spiny Goldenweed	Ind.
<i>Oligoneuron rigidum</i> (L.) Small	Stiff Goldenrod	Ind.
<i>Onopordum acanthium</i> L.	Scotch Thistle	Adv.
<i>Picradeniopsis oppositifolia</i> (Nutt.) Rydb.		Ind.
<i>Podospermum laciniatum</i> L.	False Salsify	Adv.
<i>Ratibida columnifera</i> (Nutt.) Wood. & Standl.	Prairie Cone-flower	Ind.
<i>Rudbeckia hirta</i> L.	Black-eyed Susan	Ind.
<i>R. laciniata</i> L.		
var. <i>ampla</i> (Nels.) Cronquist	Tall Cone-flower	Ind.
<i>Senecio integerrimus</i> Nutt.	Common Spring Senecio	Ind.
<i>S. spartioides</i> T. & G.	Broom Senecio	Ind.
<i>Solidago gigantea</i> Ait.	Late Goldenrod	Ind.
<i>S. missouriensis</i> Nutt.	Smooth Goldenrod	Ind.
<i>S. mollis</i> Bartl.	Goldenrod	Ind.
<i>S. nana</i> Nutt.	Low Goldenrod	Ind.
<i>Sonchus asper</i> (L.) Hill	Spiny Sow-thistle	Ind.
<i>Taraxacum officinale</i> Wiggers	Common Dandelion	Adv.
<i>Tragopogon dubius</i> Scop.	Salsify	Adv.
<i>T. porrifolius</i> L.	Salsify	Adv.
<i>Xanthium strumarium</i> L.	Cocklebur	Adv.
CONVOLVULACEAE Morning-glory Family		
<i>Convolvulus arvensis</i> L.	Small Bindweed	Adv.
CRUCIFERAE (BRASSICACEAE) Mustard Family		
<i>Alyssum minus</i> (L.) Rothmaler	Alyssum	Adv.
<i>Arabis glabra</i> (L.) Bernh.	Tower Mustard	Ind.
<i>Barbarea orthoceras</i> Ledeb.	Winter-cress	Ind.
<i>B. vulgaris</i> R. Br.	Winter-cress	Adv.
<i>Berteroa incana</i> (L.) DC.		Adv.
<i>Camelina microcarpa</i> Andr.	False Flax	Adv.
<i>Cardaria chalapensis</i> (L.) Handel-Mazzetti	Whiteweed	Adv.
<i>C. draba</i> (L.) Desv.	Whiteweed	Adv.
<i>Chorisporea tenella</i> (Pallas) DC.	Blue Mustard	Adv.
<i>Descurainia sophia</i> (L.) Webb	Flixweed	Adv.
<i>Erysimum repandum</i> L.	Spreading Wormseed	Adv.
<i>Lepidium campestre</i> (L.) R. Br.	Field-cress	Adv.
<i>L. latifolium</i> L.	Perennial Pepper-grass	Adv.
<i>Nasturtium officinale</i> R. Br.	Water-cress	Ind.
<i>Rorippa sphaerocarpa</i> (Gray) Britt.	Cress	Ind.
<i>R. teres</i> (Michx.) Stuckey	Cress	Ind.
<i>Sisymbrium altissimum</i> L.	Jim Hill Mustard	Adv.
<i>Thlaspi arvense</i> L.	Penny-cress	Adv.
CUCURBITACEAE Gourd Family		
<i>Echinocystis lobata</i> (Michx.) T. & G.	Mock Cucumber	Ind.
ELAEAGINACEAE Oleaster Family		
<i>Elaeagnus angustifolia</i> L.	Russian-olive	Adv.
EUPHORBIACEAE Spurge Family		
<i>Chamaesyce glyptosperma</i> (Engelm.) Small	Spurge	Ind.
<i>C. serpyllifolia</i> (Pers.) Small	Thyme-leaved Spurge	Ind.
<i>Euphorbia dentata</i> Michx.		Ind.
<i>E. marginata</i> Pursh	Snow-on-the-mountain	Ind.
FUMARIACEAE Fumatory Family		
<i>Fumaria officinalis</i> L.		Adv.
GERANIACEAE Geranium Family		
<i>Erodium cicutarium</i> (L.) L'Her	Filaree	Adv.
GROSSULARIACEAE Currant Family		
<i>Ribes americanum</i> Mill.	Currant	Ind.
<i>R. aureum</i> Pursh	Golden Currant	Ind.
HYDROPHYLLACEAE Waterleaf Family		
<i>Ellisia nyctelea</i> L.	Ellisia	Ind.
<i>Hydrophyllum fendleri</i> (Gray) Heller	Fendler Waterleaf	Ind.
<i>Phacelia alba</i> Rydb.	Scorpion-weed	Ind.
<i>P. heterophylla</i> Pursh	Scorpion-weed	Ind.

HYPERICACEAE St. Johnswort Family		
<i>Hypericum perforatum</i> L.	Klamath Weed	Ind.
LABIATAE (LAMIACEAE) Mint Family		
<i>Leonurus cardiaca</i> L.	Motherwort	Adv.
<i>Lycopus americanus</i> Muehl.	Water Horehound	Ind.
<i>Mentha arvensis</i> L.	Field Mint	Ind.
<i>Moldavica parviflora</i> (Nutt.) Britt.	Dragonhead	Ind.
<i>Monarda fistulosa</i> L.		
var. <i>menthaefolia</i> (Graham) Fern.	Pink Bergamot	Ind.
<i>Nepeta cataria</i> L.	Catnip	Adv.
LEGUMINOSAE (FABACEAE) Pea Family		
<i>Amorpha fruticosa</i> L.		
var. <i>occidentalis</i> (Abrams) Kearney		
& Peebles	Lead Plant	Ind.
<i>Astragalus agrestis</i> Dougl. ex G. Don	Milk Vetch	Ind.
<i>A. crassicaarpus</i> Nutt.	Ground-plum	Ind.
<i>A. drummondii</i> Dougl. in Hook.	Milk Vetch	Ind.
<i>A. flexuosus</i> (Dougl. ex Hook.) G. Don	Wiry Milk Vetch	Ind.
<i>Glycyrrhiza lepidota</i> Pursh	Wild Liquorice	Ind.
<i>Medicago lupulina</i> L.	Black Medic	Adv.
<i>M. sativa</i> L.	Alfalfa	Adv.
<i>Melilotus alba</i> Desr.	White Sweet-clover	Adv.
<i>M. officinalis</i> (L.) Lam.	Yellow Sweet-clover	Adv.
<i>Psoralea tenuiflora</i> Pursh	Scurf Pea	Ind.
<i>Robinia pseudoacacia</i> L.	Black Locust	Adv.
<i>Thermopsis divaricarpa</i> Nels.	Gold Banner	Ind.
<i>Trifolium hybridum</i> L.	Alsike Clover	Adv.
<i>T. pratense</i> L.	Red Clover	Adv.
<i>T. repens</i> L.	White Dutch Clover	Adv.
<i>Vicia americana</i> Muehl.	Vetch	Ind.
LINACEAE Flax Family		
<i>Linum lewisii</i> Pursh	Wild Flax	Ind.
MALVACEAE Mallow Family		
<i>Malva neglecta</i> Wallr.	Cheeseweed	Adv.
<i>Sphaeralcea coccinea</i> (Pursh) Rydb.	Copper Mallow	Ind.
MORACEAE Mulberry Family		
<i>Humulus lupulus</i> L.		
var. <i>neomexicanus</i> Nels. & Cockerell	Wild Hops	Ind.
NYCTAGINACEAE Four-o'clock Family		
<i>Oxybaphus nyctagineus</i> (Michx.) Porter		
& Coulter	Heart-leaved Umbrella-wort	Ind.
ONAGRACEAE Evening-Primrose Family		
<i>Epilobium adenocaulon</i> Hausskn.	Willow-herb	Ind.
<i>Gaura coccinea</i> Nutt.	Scarlet Gaura	Ind.
<i>G. parviflora</i> Dougl. ex Hook.	Tall Gaura	Ind.
<i>Oenothera albicaulis</i> Pursh	Prairie Evening-primrose	Ind.
<i>O. brachycarpa</i> Gray	Yellow Stemless Evening-primrose	Ind.
<i>O. coronopifolia</i> T. & G.	Cut-leaf Evening-primrose	Ind.
<i>O. strigosa</i> (Rydb.) Mack. & Bush	Common Evening-primrose	Ind.
OXALIDACEAE Wood-sorrell Family		
<i>Oxalis dillenii</i> Jacq.	Wood-sorrel	Ind.
<i>O. stricta</i> L.	Wood-sorrel	Ind.
PAPAVERACEAE Poppy Family		
<i>Argemone polyanthemus</i> (Fedde)		
G.B. Ownbey	Prickly Poppy	Ind.
PLANTAGINACEAE Plantain Family		
<i>Plantago lanceolata</i> L.	English Plantain	Adv.
<i>P. major</i> L.	Common Plantain	Adv.
POLEMONIACEAE Phlox Family		
<i>Collomia linearis</i> Nutt.	Collomia	Ind.
<i>Microsteris gracilis</i> (Dougl.) Greene		Ind.
POLYGONACEAE Buckwheat Family		
<i>Eriogonum effusum</i> Nutt.	Bushy Eriogonum	Ind.
<i>Persicaria lapathifolia</i> (L.) S. Gray	Smartweed	Ind.
<i>P. maculata</i> (Raf.) S. Gray	Lady's Thumb	Adv.

<i>P. pensylvanica</i> (L.) Gomez.	Smartweed	Ind.
<i>Polygonum aviculare</i> L.	Devils Shoestrings	Adv.
<i>P. convolvulus</i> L.	Black Bindweed	Adv.
<i>P. engelmannii</i> Greene	Knotweed	Ind.
<i>P. ramosissimum</i> Michx.	Bushy Knotweed	Adv.
<i>Rumex acetosella</i> L.	Sheep Sorrel	Adv.
<i>R. crispus</i> L.	Curly Dock	Adv.
<i>R. salicifolius</i> Weinm.		
ssp. <i>triangulivalvis</i> Danser	Willow Dock	Ind.
PORTULACACEAE Purslane Family		
<i>Portulaca oleracea</i> L.	Common Purslane	Adv.
RANUNCULACEAE Buttercup Family		
<i>Clematis ligusticifolia</i> Nutt.	Western Virgins Bower	Ind.
<i>Delphinium geyeri</i> Greene	Geyer Larkspur	Ind.
<i>D. nelsonii</i> Greene	Nelson Larkspur	Ind.
<i>Ranunculus macounii</i> Britt.	Buttercup	Ind.
ROSACEAE Rose Family		
<i>Crataegus douglasii</i> Lindl.	Hawthorn	Ind. 237
<i>Rosa arkansana</i> Porter	Wild Rose	Ind.
<i>Potentilla norvegica</i> L.	Norway Cinquefoil	Adv.
<i>P. recta</i> L.	Cinquefoil	Adv.
<i>Prunus americana</i> Marsh	Wild Plum	Ind.
<i>P. virginiana</i> L.		
var. <i>melanocarpa</i> (Nels.) Sarg.	Choke Cherry	Ind.
<i>Rubus occidentalis</i> L.	Black Raspberry	Adv.
RUBIACEAE Madder Family		
<i>Galium aparine</i> L.	Goosegrass	Ind.
<i>G. spurium</i> L.	False Cleavers	Adv.
SALICACEAE Willow Family		
<i>Populus X acuminata</i> Rydb.	Cottonwood	Ind.
<i>P. angustifolia</i> James	Narrowleaf Cottonwood	Ind.
<i>P. deltoides</i> Marsh.	Plains Cottonwood	Ind.
<i>Salix amygdaloides</i> Anderss.	Peach-leaved Willow	Ind.
<i>S. exigua</i> Nutt.	Sandbar Willow	Ind.
<i>S. irrorata</i> Anderss.	Bluestem Willow	Ind.
<i>S. lutea</i> Nutt.	Willow	Ind.
<i>S. sp.</i>	Willow	Ind.
SANTALACEAE Sandalwood Family		
<i>Comandra umbellata</i> (L.) Nutt.	Bastard Toadflax	Ind.
SCROPHULARIACEAE Figwort Family		
<i>Castilleja integra</i> Gray	Orange Paintbrush	Ind.
<i>Penstemon alpinus</i> Torr.	Alpine Penstemon	Ind.
<i>P. virgatus</i> Gray		
ssp. <i>asa-grayi</i> Corsswhite	Penstemon	Ind.
<i>P. secundiflorus</i> Benth.	One-sided Penstemon	Ind.
<i>Scrophularia lanceolata</i> Pursh	Figwort	Ind.
<i>Verbascum thapsus</i> L.	Great Mullein	Adv.
<i>Veronica americana</i> (Raf.) Schwein.	American Brooklime	Ind.
<i>V. anagallis-aquatica</i> L.	Water Speedwell	Ind.
<i>V. peregrina</i> L.		
ssp. <i>xalapensis</i> (H.B.K.) Pennell	Purslane Speedwell	Adv.
SOLANACEAE Potato Family		
<i>Physalis heterophylla</i> Nees	Ground-cherry	Ind.
<i>P. virginiana</i> Mill.		
ssp. <i>sonorae</i> (Torr.) Waterfall	Ground-cherry	Ind.
<i>Solanum rostratum</i> Dunal	Buffalo-Bur	Ind.
<i>S. sarachoides</i> Sendtn. ex Mart.	Nightshade	Adv.
<i>S. triflorum</i> Nutt.	Cut-leaved Nightshade	Ind.
ULMACEAE Elm Family		
<i>Ulmus pumila</i> L.	Siberian Elm	Adv.
UMBELLIFERAE (APIACEAE) Parsley Family		
<i>Berula erecta</i> (Huds.) Coville		Ind.
<i>Cicuta douglasii</i> (DC.) C. & R.	Water Hemlock	Ind.
<i>Conium maculatum</i> L.	Poison Hemlock	Adv.
<i>Cymopterus montanus</i> Nutt.		Ind.

<i>Heracleum sphondylium</i> L.		
ssp. <i>montanum</i> (Schleich. ex Gaud.)		
Briquet	Cow Parsnip	Ind.
<i>Musineon divaricatum</i> (Pursh) Nutt.		Ind.
<i>Osmorhiza longistylis</i> (Torr.) DC.	Sweet Cicely	Ind.
URTICACEAE Nettle Family		
<i>Urtica dioica</i> L.		
ssp. <i>gracilis</i> (Ait.) Selander	Stinging Nettle	Ind.
VERBENACEAE Vervain Family		
<i>Verbena bracteata</i> Lag. & Rodr.	Vervain	Adv.
<i>V. hastata</i> L.	Blue Vervain	Ind.
VIOLACEAE Violet Family		
<i>Viola canadensis</i> L.	Canada Violet	Ind.
<i>V. nuttallii</i> Pursh	Nuttall Violet	Ind.
VITACEAE Grape Family		
<i>Parthenocissus inserta</i> (Kerner) Fritsch	Virginia Creeper	Ind.
<i>Vitis riparia</i> Michx.	Wild Grape	Ind.
ZYGOPHYLLACEAE Caltrop Family		
<i>Tribulus terrestris</i> L.	Puncture-vine	Adv.
Class: MONOCOTYLEDONEAE Monocots		
AGAVACEAE Agave Family		
<i>Yucca glauca</i> Nutt.	Spanish Bayonet	Ind.
ALISMATACEAE Water-plantain Family		
<i>Alisma plantago-aquatica</i> L.		
ssp. <i>brevipes</i> (Greene) Samuelsson	Water-plantain	Ind.
COMMELINACEAE Spiderwort Family		
<i>Tradescantia occidentalis</i> (Britt.) Smyth	Spiderwort	Ind.
CYPERACEAE Sedge Family		
<i>Carex brevior</i> (Dewey) Mack.	Carex	Ind.
<i>C. lanuginosa</i> Michx.	Carex	Ind.
<i>C. nebrascensis</i> Dewey	Carex	Ind.
<i>C. praegracilis</i> Boott	Carex	Ind.
<i>C. utriculata</i> Boott	Carex	Ind.
<i>Eleocharis macrostachya</i> Britt.	Spike-rush	Ind.
<i>Scirpus acutus</i> Muehl.	Bulrush	Ind.
<i>S. americanum</i> Pers.	Three-square	Ind.
<i>S. lacustris</i> L.		
ssp. <i>validus</i> (Vahl) Koyama	Great Bulrush	Ind.
<i>S. microcarpus</i> Presl.	Bulrush	Ind.
<i>S. pallidus</i> (Britt.) Fern.	Bulrush	Ind.
GRAMINEAE (POACEAE) Grass Family		
<i>Aegilops cylindrica</i> Host.	Goat-grass	Adv.
<i>X Agrohordeum macounii</i> (Vasey) Lepage		Ind.
<i>Agropyron cristatum</i> (L.) Gaertn.	Crested Wheat-grass	Adv.
<i>A. elongatum</i> (Host.) Loeve	Tall Wheat-grass	Adv.
<i>A. intermedium</i> (Host.) Beauv.		
var. <i>intermedium</i>	Intermediate Wheat-grass	Adv.
<i>A. intermedium</i> (Host.) Beauv.		
var. <i>trichophorum</i> (Link) Halac.	Intermediate Wheat-grass	Adv.
<i>A. repens</i> (L.) Beauv.	Quack Grass	Adv.
<i>A. smithii</i> Rydb.	Western Wheat-grass	Ind.
<i>A. trachycaulum</i> (Link) Malte	Slender Wheat-grass	Ind.
<i>Agrostis gigantea</i> Roth	Red-top	Adv.
<i>A. palustris</i> Huds.	Bentgrass	Unc.
<i>Alopecurus aequalis</i> Sobol.	Short-awn foxtail	Ind.
<i>Aristida longiseta</i> Steud.	Red Three-awn	Ind.
<i>Avena fatua</i> L.	Wild Oats	Adv.
<i>Bouteloua curtipendula</i> (Michx.) Torr.	Side-oats Grama	Ind.
<i>B. gracilis</i> (H.B.K.) Lag.	Blue Grama	Ind.
<i>Bromus ciliatus</i> L.	Fringed Brome	Ind.
<i>B. inermis</i> Leysser	Smooth Brome	Ind.
<i>B. japonicus</i> Thunberg	Japanese Brome	Adv.
<i>B. marginatus</i> Nees ex. Steud.	Rescue-grass	Adv.
<i>B. tectorum</i> L.	Cheat-grass	Adv.

<i>Buchloe dactyloides</i> (Nutt.) Engelm.	Buffalo-grass	Ind.
<i>Dactylis glomerata</i> L.	Orchard-grass	Adv.
<i>Echinochloa crus-galli</i> (L.) P. Beauv.	Barnyard-grass	Adv.
<i>Elymus canadensis</i> L.	Canada Wild-rye	Ind.
<i>E. cinereus</i> Scribn. & Merr.	Giant Wild-rye	Ind.
<i>E. virginicus</i> L.	Virginia Wild-rye	Ind.
<i>Eragrostis cilianensis</i> (All.) Lutati	Stinkgrass	Adv.
<i>E. diffusa</i> Buck.	Spreading Love-grass	Ind.
<i>E. poaeoides</i> Beauv. ex Roem. & Schult.	Love-grass	Adv.
<i>Festuca pratensis</i> Huds.	Meadow Fescue	Adv.
<i>Glyceria striata</i> (Lam.) Hitchc.	Fowl Manna-Grass	Ind.
<i>Hordeum jubatum</i> L.	Foxtail Barley	Ind.
<i>Lolium perenne</i> L.	Perennial Rye-grass	Adv.
<i>L. multiflorum</i> Lam.	Italian Rye-grass	Adv.
<i>Muhlenbergia asperifolia</i> (N.&M.) Parodi	Alkali Muhly	Ind.
<i>M. racemosa</i> (Michx.) B.S.P.	Marsh Muhly	Ind.
<i>Panicum capillare</i> L.		
var. <i>occidentale</i> Rydb.	Witchgrass	Unc. 239
<i>Phalaris arundinacea</i> L.	Reed Canary-grass	Adv.
<i>Phleum pratense</i> L.	Timothy	Adv.
<i>Poa agassizensis</i> Boivin & D. Love	Native Kentucky Blue-grass	Ind.
<i>P. compressa</i> L.	Canada Blue-grass	Ind.
<i>P. palustris</i> L.	Fowl Blue-grass	Ind.
<i>P. pratensis</i> L.	Kentucky Blue-grass	Adv.
<i>P. trivialis</i> L.	Rough Blue-grass	Adv.
<i>Polypogon monspeliensis</i> (L.) Desf.	Rabbitfoot-grass	Adv.
<i>Secale cereale</i> L.	Rye	Adv.
<i>Setaria viridis</i> (L.) P. Beauv.	Green Bristle-grass	Adv.
<i>Sitanion longifolium</i> J.G. Smith	Squirreldail	Ind.
<i>Sphenopholis obtusata</i> (Michx.) Scribn.	Prairie Wedge-grass	Ind.
<i>Sporobolus cryptandrus</i> (Torr.) A. Gray	Sand Dropseed	Ind.
<i>Stipa comata</i> Trin. & Rupr.	Needle-and-thread	Ind.
<i>S. viridula</i> Trin.	Green Needle-grass	Ind.
<i>Triticum aestivum</i> L.	Wheat	Adv.
JUNCACEAE Rush Family		
<i>Juncus articus</i> Willd.		
ssp. <i>ater</i> (Rydb.) Hulten	Rush	Ind.
<i>J. bufonius</i> L.	Rush	Adv.
<i>J. compressus</i> L.	Rush	Ind.
<i>J. dudleyi</i> Wieg.	Rush	Ind.
<i>J. interior</i> Wieg.	Rush	Ind.
<i>J. saximontanus</i> Nels.	Rush	Ind.
<i>J. torreyi</i> Cov.	Rush	Ind.
LEMNACEAE Duckweed Family		
<i>Lemna minor</i> L.	Duckweed	Ind.
LILIACEAE Lily Family		
<i>Allium textile</i> Nels. & Macbr.	Wild Onion	Ind.
<i>Asparagus officinalis</i> L.	Asparagus	Adv.
<i>Leucocrinum montanum</i> Nutt.	Sand Lily	Ind.
<i>Smilacina stellata</i> (L.) Desf.	Few-flowered False Solomon's Seal	Ind.
POTAMOGETONACEAE Pondweed Family		
<i>Potamogeton</i> sp.	Pondweed	Ind.
SPARGANIACEAE Bur-reed Family		
<i>Sparganium</i> sp.	Bur-reed	Ind.
TYPHACEAE Cat-tail Family		
<i>Typha latifolia</i> L.	Broad-leaved Cat-tail	Ind.
ZANNICHELLIACEAE Horned Pondweed Family		
<i>Zannichellia palustris</i> L.	Horned Pondweed	Ind.
Division: PTERIDOPHYTA		
EQUISETACEAE Horsetail Family		
<i>Equisetum arvense</i> L.	Field Horsetail	Ind.
<i>Hippochaete laevigata</i> (A.Br.) Farwell	Horsetail	Ind.

A New Concept: Nebraska Statewide Arboretum

George Briggs

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Folklorist Roger Welsch tells of a Nebraska pioneer writing his brother in the East and saying that here they "could put a plow in the ground at Nebraska City and go two hundred miles straight west without ever stopping for a root or a rock."

In his publication *Of Trees and Dreams*, Welsch continues: "And yet for all the freedom and openness of this new land, the pioneers missed their trees. For hundreds of generations in Europe and the eastern United States men had built with wood. Art came from wood, and cradles, and weapons, food, heat and shelter, books, clothing, furniture, and even tools. Soon the gentle longing for trees grew to an ache, even an obsession."

Compared to the forestland of the Appalachians or northern Pacific coast, Nebraska was indeed a flat, homogenous plain. But, even though Nebraska lies in the heart of the Great Plains, its topography and vegetative character are far more diverse than most Americans from the east or west coasts expect. The windy climate of cold winters and hot, dry summers does limit the palette of plant materials—more so

in the western portion of the state than in the east. As one travels from the southeast to the northwest corner of the state, rainfall diminishes from 36 inches per year to around 17 inches; and the elevation rises from just a few hundred feet above sea level near the Missouri River to over 5,000 feet in the west.

Diversity

Within the apparent uniformity of this vast, sloping plain is great diversity; particularly in plant communities. Along the Missouri River the land rolls gently, reflecting the etching of the tributaries and drainageways of surface water making its way east. The stately bur oak, somewhat gnarled by the stress of life in the region, congregates in groves to form the primary tree vegetation. The Platte River meanders across central Nebraska, bordered by expanses of flat floodplain and lined with generous allocations of the state tree, the cottonwood. The Sandhills, a rolling expanse of sand dunes cloaked in native grass, occupy a fourth of the state's land area in north-central Nebraska. These fragile, windswept hills lack trees except for occasional junipers or others that tenacious ranchers have established. The state's westernmost region, the Pine Ridge, is a picturesque assortment of buttes and ridges speckled with ponderosa pine and blankets of native grasses.

George Briggs is director of the Nebraska Statewide Arboretum. This article is reprinted by permission from *NEBRASKAland Magazine* 61(3):9-15,44 (April 1983), published by Nebraska Game and Parks Commission.

Although Nebraska is not as destitute of woodlands as travelers across it may suspect, in historic times it has never been, or ever will be, a region of vast forests. When the white settlers first crossed the Missouri, about three percent of the state was wooded. After seeing that figure cut to one percent by the pressures to increase row crop production, the state struggled back to two percent forestland. Then, an average of 8,500 acres of trees have been lost during each of the last 20 years. As more trees and woodlands disappear, there has been a resurgence of that pioneer longing for summer shade, relief from winter winds, and aesthetic pleasure that trees afford in an otherwise monotonous landscape of cropland and pasture. Once Nebraska's official nickname was the "Tree Planter's State," and the title may once again be deserved.

Arbor Lodge—the First Site

The Nebraska State Arboretum (NSA) was born out of this reverence for trees, because of their scarcity and loss. The idea of a statewide system of arboreta germinated during the late 1960's and early 70's. Through the combined efforts of the University of Nebraska, garden clubs across the state, and other interested citizens, the concept gained momentum until the first site, Arbor Lodge, was affiliated in 1976. Since it was the estate of J. Sterling Morton, who served as U.S. Secretary of Agriculture under Grover Cleveland, Arbor Lodge supplied the early credibility and recognition necessary to establish NSA as a well-founded institution.

This early association with Arbor Lodge was timely in that Morton, having a voracious "appetite" for plants—as Arbor Lodge's extensive

plantings will testify—initiated Arbor Day as a state holiday during his tenure as president of the Nebraska State Board of Agriculture. The first Arbor Day in 1874 prompted the planting of over a million trees in the state. In Morton's words: "Other holidays repose upon the past—Arbor Day proposes for the future." Having now been adopted by many other states and foreign countries, Arbor Day, as well as Arbor Lodge, are sources of pride for Nebraskans.

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Building on that pride, NSA attracted other sites with significant plantings, and affiliated several prior to its establishment as a non-profit corporation in February 1978. NSA is a joint venture with the University of Nebraska, but is autonomous, being governed by a 27-member advisory council of persons from various agencies and locations. Arboretum policy is defined by a seven-member executive board composed of individuals with various skills such as in finance, design, nursery management, and education. Funding comes from memberships and donations, as well as from the University of Nebraska's Institute of Agriculture and Natural Resources.



Cottonwood—*Populus deltoides*

Local People Involved

In a nutshell, the NSA is a response to the need to involve people, on the local level, in the enjoyment of developing, managing, and visiting an arboretum. Granted, these local arboreta are and will continue to be much more modest than the typical American arboretum. Collectively, however, the 27 NSA sites make an impressive impact.

242 Although it is a young organization, NSA is growing quickly. As people around the state hear that an arboretum is being developed on a site similar to their own, they begin to think of possibilities at home.

The overriding goal of NSA is to help develop arboreta on sites having either interesting plantings or supporters committed to developing an arboretum. We take into account the broad range of community sizes and the varying ability to plan and fund an arboretum, assessing the potential of each site in terms of its context and the long-range benefits it promises.

To become part of the NSA system, supporters of the site must initiate the process by requesting information. Because of our concern with continuity and longevity, we don't twist arms to sign up with new sites. In fact, we set rigorous standards of entry to test a site's "seriousness of purpose." If, during a visit by the NSA director, the site shows promise, a formal written application is filed. This document reports various aspects of the site, including a listing of existing plant material, budget allocations to landscape development, and the sanction of the governing body.

Applying sites learn that participation in NSA involves not only

physical landscape development, but also ongoing commitment to interpretation, public education and plant evaluation. In addition, they learn that NSA stresses planning. Prospective sites must consider in detail how the arboretum will relate to the purposes of the organization planning it, and are encouraged to prepare a master plan based on their goals and objectives. To ensure longevity, sites must also have a central steering committee to implement the master plan, appoint a curator to manage the arboretum, and organize a "friends" group to muster local support. These requirements, made known early, separate the serious from the speculative.

Following formal application, a site is visited by a committee to determine such things as number of species, maintenance of plantings, administrative support, ability to acquire resources, and educational potential. If the committee responds favorably, a memorandum of understanding is drafted and negotiated. The memorandum and the committee report are presented to the NSA executive board for approval. The board may either accept the site as an affiliate, grant provisional approval based on fulfillment of certain requirements, or deny affiliation.

Help from NSA

Once a site gains affiliation, the NSA office helps with plant acquisition, labeling, brochures, organizing a public dedication, and planning. We also coordinate activities for curators so that they may exchange ideas and learn from each other. It is important that a curator accomplish certain educational and planting goals relatively soon to take advantage of the momentum

that builds during the approval process and dedication.

Such a strong, early start, however, is not always essential. For example, the state fairgrounds in Lincoln received provisional status over two years ago, but made little progress until recently. During the past year, though, curator John Skold hired a local planning firm to prepare a program statement for the fair arboretum, requested proposals for a master plan, and completed a youth complex which, for the first time in the fair's history, included an interesting landscape as part of the development.

Another example of a delayed development is at Nebraska Wesleyan University in Lincoln. After several years of moderate arboretum development following its affiliation, Wesleyan recently received a substantial financial commitment from Lincoln philanthropist Alice Abel, earmarked for restoration of the campus landscape. The Wesleyan facility, now renamed the Alice Abel Arboretum, promises to be an exemplary site within the system. These late-blooming sites dramatically demonstrate the value of patient encouragement, and the benefits to an institution of working to identify itself as an arboretum.

Each Site Unique

In reviewing site applications, NSA consciously holds no preconceptions as to what type of facility could constitute an arboretum. So long as the basic requirements are addressed by the site, we strive to encourage arboretum development rather than to discourage it. Consequently, each new site represents a unique set of circumstances. Among the more unusual is the Elks

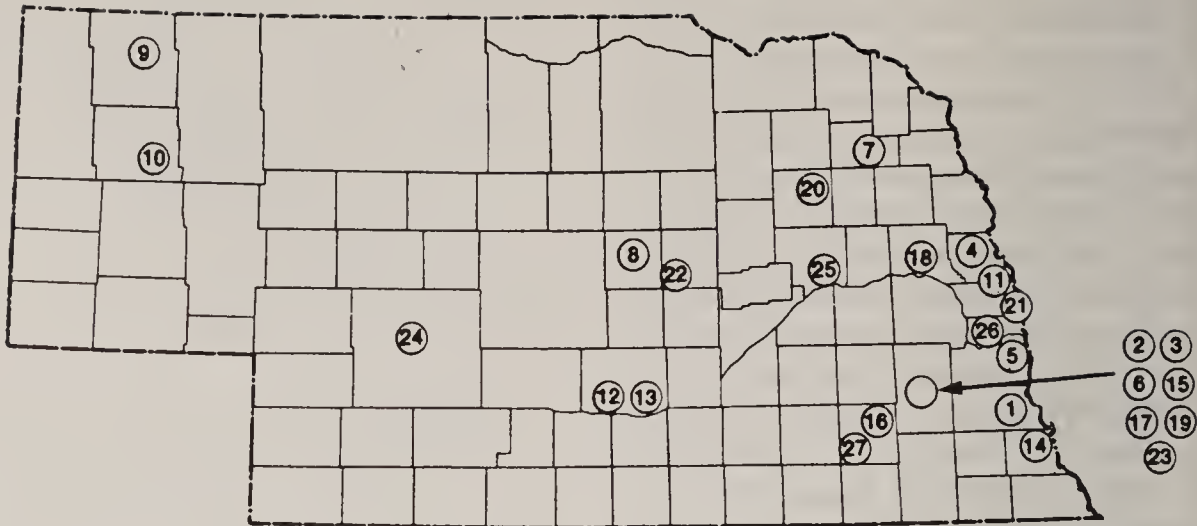


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Bur Oak—*Quercus macrocarpa*

Country Club in Columbus. Developed 18 years ago on treeless agricultural land, the organizers began early to give the golf course form by planting thousands of trees. As interest in the arboretum grew, local nurseryman Allen Wilke provided guidance by expanding the species list. In approving the site, NSA required public access to the course for arboretum tours and walks. The course is now available each Monday, when play is suspended for maintenance, and on other days by appointment with the golf professional.

A relationship of close cooperation with various state agencies has allowed NSA to work as a catalyst in projects that otherwise may not have been undertaken.



- | | |
|---|---|
| 1. Arbor Lodge State Historical Park—Nebraska City | 14. Thousand Oaks Arboretum—Peru State College, Peru |
| 2. Maxwell Arboretum—UNL East Campus, Lincoln | 15. Nebraska State Fairgrounds—Lincoln |
| 3. Chet Ager Nature Center—Lincoln | 16. Doane College—Crete |
| 4. Blair City Park—Blair | 17. Hans Burchardt Arboretum—Lincoln |
| 5. Horning State Farm—Plattsmouth | 18. Hormel Park—Fremont |
| 6. Alice Abel Arboretum—Nebraska Wesleyan University, Lincoln | 19. Prairie Pines—Lincoln |
| 7. Wayne State College—Wayne | 20. Maskenthine Arboretum—Norfolk |
| 8. Aagaard Farm—Ord | 21. Elmwood Arboretum—Omaha |
| 9. Chadron State College—Chadron | 22. Chalk Mine Wayside—Scotia |
| 10. Sallows Arboretum and Conservatory—Alliance | 23. Joshua C. Turner Arboretum—Union College, Lincoln |
| 11. Dana College—Blair | 24. Glenn Viehmeyer Arboretum—North Platte Station |
| 12. Cottonmill Park—Kearney | 25. Elks Country Club—Columbus |
| 13. Kearney State Arboretum—Kearney | 26. Bellevue College Arboretum—Bellevue |
| | 27. Crete Public Schools Arboretum—Crete |

Affiliated Arboretum Sites

A current project is under way with the Nebraska Department of Economic Development to landscape the Nebraska/Omaha Information Center near Interstate 80 in South Omaha. Plantings of native trees, shrubs and grasses, along with an interpretive brochure, will help orient visitors to Nebraska’s landscape and plant resources.

The Nebraska Game and Parks Commission has sponsored two arboretum sites in addition to Arbor Lodge. The Hans Burchardt Arboretum at Branched Oak Lake near Lincoln was dedicated in 1982. It includes plants gathered from around the region for testing and use on wildlife lands and park areas. The third site is Chalkmine State

Wayside Area near Scotia. This site is unique in that the plants are entirely native species. Chalkmine's trees along the nature trail will be identified and labeled.

Other sites include local parks, a highway wayside area, natural resources district lands, plant research stations, a secondary school, and 11 college or university campuses.

The network of arboretums provides an ideal medium for testing and evaluating plant materials throughout the climatic regions of the state.

To fulfill the educational potential that the system of arboretums offers, NSA is seeking funding for a permanent educational director. In a prairie state such as Nebraska, making these collections of trees, shrubs and herbaceous plants available for study by young people is particularly important. As more

arboretums are affiliated across the state, and are fully developed, they will be used more and more by school groups, for workshops and for self-guided tours.

The most gratifying aspect of NSA is the mood of our supporters. The feeling is positive, and the sites support each other's efforts rather than competing. Sometimes development is slower than we would hope, but as a group, the affiliates are tenacious, refusing to abandon their goals in spite of setbacks. It is in this regard, perhaps, that the association with others has been most rewarding.

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In its statewide arboretum system, Nebraska, we feel, has planted a seed that will grow and spread its kind across the state and perhaps even into other states where a gentle longing for trees has grown into an ache. But of course, what pioneer worth his salt wouldn't feel that way? □

A Cooperative Oak Evaluation Project

W. Richard Hildreth

In the spring of 1983, several oak seedlings were planted at the Denver Botanic Gardens. These oaks were received as acorns from the State Arboretum of Utah, University of Utah, in the autumn of 1982.

W. Richard Hildreth, Ph.D., is director of the State Arboretum of Utah, University of Utah, Salt Lake City.

What is so special about these particular plants? The seedlings so carefully nurtured at DBG represent second generation progeny of a group of hybrid oaks which are new to science. The planting at DBG is one of a series of test plots established on a cooperative basis by the State Arboretum of Utah with other gardens throughout the U.S. Since 1976, out-plantings have been made

in California, Ohio, Tennessee, Texas, Washington, D.C., North Dakota, Montana, Arizona, Utah, and now Colorado. The project coordinator is W. Richard Hildreth, Director of the State Arboretum of Utah.

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The story behind these unique trees actually had its beginning on May 23, 1954. Rudy Drobnick, then a graduate student in the Botany Department at the University of Utah, was descending the slopes of the Oquirrh Mountains to the west of Salt Lake City at the south end of the Great Salt Lake. His attention was drawn to a particular clump of scrub oak which he noted had leaves not quite like those of the typical gambel oak scattered over these mountains and other ranges in Utah. He brought specimens to Dr. Walter P. Cottam at the University who confirmed that this was an exciting new find.

Specimens were sent to Dr. Cornelius H. Muller at the University of California at Santa Barbara. He identified the oak as a hybrid cross between the common gambel oak (*Quercus gambelii* Nutt.) and the Dixie live oak (*Quercus turbinella* Greene). The hybrid was confirmed later by Dr. John M. Tucker at the University of California, Davis.

Comparing the leaves of the supposed parents with the suspected hybrid, he noted that gambel oak is characterized by large, relatively thin and roundly lobed leaves. Dixie live oak has small, thick, pointed-lobed leaves which are silvery green in color. Leaves of the hybrid were intermediate in size, green, sharply toothed and leathery in texture. Other hybrid specimens were subsequently found throughout the range of gambel oak in Utah.

It was concluded that some 7,500 years ago the live oak (*Q. turbinella*) which now resides only in southwestern Utah had migrated northward along the base of the various mountain chains for a distance of some 250 miles. It freely crossed with the resident gambel oak when the climate was warmer and drier during the epoch when Lake Bonneville covered much of the Great Basin region. When the climate changed to our modern one, the live oak died, unable to cope with the more rigorous winters. The hybrids survived along with gambel oak because of genes conferring cold resistance.

Additional confirmation of hybridity included 1) evaluation of segregates resulting from self-fertilization and 2) artificial reproduction of the hybrid. Acorns harvested from an isolated putative hybrid in 1959 from the Oquirrh Mountains showed the typical range of leaf segregates characteristic of F_2 hybrids. At one extreme were leaves resembling *Q. gambelii*; at the other extreme were leaves resembling the other suspected parent *Q. turbinella*. The final confirmation was secured by reciprocally crossing *Q. gambelii* and *Q. turbinella* in 1964. The leaves of the progenies of these crosses matched those of the natural hybrids seen throughout Utah.

The actual hybridizing was relatively simple because of a standard procedure for pollination developed by Cottam and Drobnick. This encouraged them to investigate interspecific and even intergeneric hybridization in oaks.

With the few exotic oak species represented in the State Arboretum of Utah (*Q. robur* L., *Q. mongolica* Fisch ex Turez, *Q. macrocarpa*



Quercus turbinella



Quercus gambelii



Hybrid

Michx., *Q. variabilis* Blume), along with *Q. gambelii* and *Q. turbinella* a grand orgy of hybridization was planned. Friends, relatives and colleagues sent catkins containing pollen from documented species throughout the U.S. Pollinations were carried out and amazingly a high percentage of successful hybridization resulted. One can imagine Cottam and Drobic eagerly harvesting acorns from the crosses of each season like a pair of squirrels carefully guarding the winter cache.

With a private donation from Mrs. Grace A. Tanner of Salt Lake City, the State Arboretum of Utah published in 1982, the results of Dr. Cottam's quarter-century of dedicated research, all accomplished after he retired from the faculty of the University of Utah. Soft bound and hard-cover editions at \$10 and \$15 respectively (plus \$1.50 for postage and handling) are available from the State Arboretum of Utah, University of Utah, Salt Lake City, Utah 84112. Proceeds from the sale of this book go towards the Cottam Research Fund.

The technical publication is entitled *Oak Hybridization at the University of Utah*, co-authored by Dr. Walter

P. Cottam, John M. Tucker, Professor of Botany and Director of the University Arboretum, University of California, Davis, and Frank S. Santamour Jr., Research Geneticist, U.S. National Arboretum, Washington, D.C.

The significance of this project is presented in the abstract of the publication: "In what must be considered the most extensive and successful controlled hybridization project in this genus in the United States, 43 different interspecific hybrid combinations and 3 intersubgeneric hybrids were produced. The majority of these hybrids are new to science."

The ongoing aspects of the research will focus on 1) evaluation and selection of superior progeny for specific characters, habitats, and landscape uses, 2) development of commercially feasible propagation techniques and 3) subsequent crosses with additional species and hybrids based on specific goals. The cooperation and participation of the Denver Botanic Gardens in this project is greatly appreciated. We look forward to observing the growth of "our" hybrid oaks at DBG and participating with DBG staff in their evaluation. □

Exotics of Colorado

Kentucky Coffee Tree, *Gymnocladus dioicus*

Helen Marsh Zeiner

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If you take a winter walk through any of Denver's city parks, you are sure to see the Kentucky coffee tree, *Gymnocladus dioicus* (L.) K. Koch. This distinctive tree is one of the most easily recognized of all trees in winter condition.

In Denver *G. dioicus* usually reaches heights of 40-50 feet. In its native habitat it grows to 80-100 feet or even more, although trees of 40-50 feet are common. The branches, stout with few branchlets, are ascending, turning slightly outward and forming a narrow somewhat rounded crown. Because of the heavy branches and coarse twigs, the tree is sometimes described as being stark. Twigs are about ½ inch in diameter with large heart-shaped leaf scars each bearing three to four conspicuous bundle scars. Two small sunken buds are superposed above the leaf scars. A cut across a twig reveals a large salmon-colored pith, a distinguishing characteristic of Kentucky coffee tree.

The gray to brown bark is rough and deeply fissured, the ridges often curling up along the sides.

Gymnocladus, from the Greek, means naked branch. The leaves come out late in the spring and drop early in the fall, so that for a period of perhaps six months the tree shows no signs of life. This has

resulted in the common names "dead tree," and "stump tree."

During the summer *G. dioicus* is clothed with large bi-pinnately compound leaves. These doubly compound leaves vary from a foot in length to as much as 3 feet and are often 2 feet wide—truly enormous leaves. Leaflets are 2 to 2½ inches long, entire, and acuminate to abruptly pointed. The very large leaves, taken as units, are arranged alternately on the heavy twigs. The first pair of basal leaflets is usually larger than the others. In autumn the leaflets turn clear yellow and drop separately.

Clusters of inconspicuous greenish-purple flowers can be found hanging among the new leaves in spring. The species name *dioicus* means two houses and refers to the fact that staminate and pistillate flowers occur on separate trees. Although *G. dioicus* is a member of Leguminosae, the pea family, the flowers are regular and not papilionaceous as is typical for this family.

The dark brown leathery pods or legumes vary from 6 to 10 inches long and 1 to 2 inches broad. Each contains six or more dark brown to black, flat round seeds about ¾ inch in diameter. The pods hang on well into winter and help identify the tree.

The names coffee tree, Kentucky coffee tree, or Kentucky coffeenut result from the fact that early

Helen Marsh Zeiner, Ph.D., honorary curator of Kathryn Kalmbach Herbarium at Denver Botanic Gardens, is a frequent contributor to *The Green Thumb*.



Gymnocladus dioica—
Kentucky Coffee Tree

settlers, even before the Revolutionary War, made a bitter coffee substitute from the seeds.

The tree grows naturally over a wide area in mid-central United States ranging from central New York through southern Ontario to southern Minnesota and south to Tennessee and Arkansas. Although widespread in its distribution, Kentucky coffee tree is nowhere common. It is usually found as a single specimen; sometimes several trees will be found growing together, and then no more will be found for miles.

G. dioica has always been so rare as to be of little economic

importance. The light red to reddish-brown, coarse-grained wood takes a polish well and has limited use in cabinet making and construction. Because it is durable in contact with the soil, it is used locally for fence posts and railroad ties.

The Kentucky coffee tree is the only representative of the genus *Gymnocladus* in North America. One other species of *Gymnocladus* exists in southern China. □

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Art and Artists

The Green Thumb—

Doris Peacock

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It was a lucky day for Denver Botanic Gardens and *The Green Thumb* magazine when Doris Peacock came to Kathryn Kalmbach Herbarium seeking help in identifying Colorado conifers. She brought with her a set of drawings of Colorado conifers which were exquisitely done and correct in every detail.

She expressed an interest in illustrating for *The Green Thumb*, and since that time (1977) has illustrated the "Exotics of Colorado" articles.

Doris has the rare ability to be both scientifically accurate and artistic, and her work has added much to the attractiveness and stature of *The Green Thumb*.

A life-long interest in nature together with the keen powers of observation of the artist have made Doris well qualified for botanical drawing. The family enjoyed camping in the Colorado mountains, and here Doris observed nature, exploring and sketching and photographing materials. All these techniques are reflected in her pen and ink drawings.

Doris received her first art recognition when she was 12 years old. She drew a poster for La Traviata, for which she was awarded a blue ribbon and a ticket to the opera. When she was 17, she was awarded a scholarship to Colorado Commercial Art School.



Centaurea cyanus—Bachelor's Button

Then came busy years when Doris raised a family of five children; but she still found time to take classes at the University of Colorado, completing first a Bachelor of Science in Education and then a Bachelor of Fine Arts under the direction of artists John Fudge, Jerry Johnson, and Ted Thomas. She continues to take occasional courses and attends workshops, constantly striving to improve her work which consists of watercolors and acrylics as well as line drawings.

Honors awarded to Doris include an original art genealogy commission through the University of Colorado and a first place at the Colorado State Fair.



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Acer plantanoides—Norway Maple

Recent exhibitions of her work include: 1982, Mitchell Hall, Denver Botanic Gardens, Colorado Watercolor Society; 1982, Boettcher Hall, Performing Arts Center, Colorado Watercolor Society; 1982, First National Bank of Denver, Regional Art Show, Nature Conservancy Benefit; and 1983, Englewood Public Library, The Colorado Conifers. In January, 1984, The Colorado Conifers will be on exhibit at the Greenwood City Hall.

At present Doris is the first grade teacher at Our Lady of Lourdes school in Denver.

A personal statement from Doris gives us an insight into her feelings about nature and how this is reflected in her accurate and beautiful botanical drawings:

“Nature is the true artist and is already complete. All we need to do is to observe and obey. A fragile morning glory with the natural complementary colors and the perfect design elements in a leaf and stem is a wondrous delight.

“My work emerges as a sum total of experience—all I have seen, read and thought about. It is deeply rooted in nature and reflects a realistic source of beauty to uplift the spirit. When a person reacts favorably, I feel he is also reacting to memories of pleasant experiences.”

HMZ



Pyrus calleryana ‘Bradford’

Hellebores— Wintertime Favorites

Panayoti Callas

252

The words Christmas rose, to many, conjure up images of rosebuds on a field of snow. In reality, Christmas rose is not a rose at all; it is in the buttercup family (Ranunculaceae).

The first encounter with *Helleborus niger* L. is often disappointing: on a cold December morning the slightly tattered foliage, already nine months old, seems to try to hide the few, furtive flowers that struggle all winter to emerge. But if the season has been mild, the pearly buds may be wide open, revealing the remarkable flowers that make the most tepid gardener a hellebore fanatic for life.

The Christmas rose at its best is stunning. Reginald Farrer, the brilliant English gardener, described its whiteness as a “dazzling chastity that seems inappropriate and hypocritical in plants so poisonous and sophisticated.” The Christmas rose and all other hellebores, in fact, possess a number of strong alkaloids in all their parts which make them as poisonous as daffodils and rhododendrons.

Surely this is a strange flower that will not set buds until the first frosts have come and is usually in plump seed when warm weather resumes in the spring. There are 16 species of *Helleborus* that range from England in the west to China in the east. All are plants of woods

and hedgerows and vary tremendously in growth habit and flower color.

Christmas rose is the most famous and perhaps the loveliest of all the hellebores. A plant of the eastern Alps, from Yugoslavia to Switzerland and Italy, it extends northward to the Black Forest of Germany and the Austrian Alps. A subalpine plant in nature, it prefers woods and thickets at higher altitudes—especially in areas abounding in limestone rock. In the wild, blooming is restricted to early spring when the heavy snows have melted. At lower, warmer altitudes, the flowers of most forms of Christmas rose often start to open in October, producing a succession of blossoms whenever warm winds raise daytime temperatures above freezing. Bloom usually peaks in March, and by April most of the flowers have formed seeds.

This is a fascinating process. The ovary is usually divided into five carpels which are very small at flowering time. Once the flower is pollinated, the entire blossom is gradually suffused with chlorophyll, and the ovary swells to a considerable size, sometimes 2 inches long. By the time the seed ripens the white flower has become a pastel green version of itself.

Over the years many forms of Christmas rose have been selected for superior habit or bloom size. Because they increase so slowly few of these clones are widely available.

Panayoti Callas, curator of the Rock Alpine Garden at Denver Botanic Gardens, is well known for his expertise and enthusiasm for rock gardening throughout the international rock gardening community.



Helleborus niger

Perhaps Potter's Wheel is the only cultivar of Christmas rose readily available and the most spectacular of the hellebores with flowers approaching 5 inches in diameter. Often the first blooms open in February and persist well into April.

An amazing variety of hellebores are commonly cultivated in European botanic gardens. Indeed, the variety of foliage and blossoms is tremendous and some are excellent garden plants in Colorado. Usually divided into stemmed and stemless species, the Christmas rose, *H. niger* L., and Lenten roses, *H. orientalis* Lam. are examples of stemless hellebores, while *H. lividus* Ait. ssp. *corsicus* (Willd.) Tutin and *H. foetidus* L. are examples of stemmed hellebores.

Stemless Hellebores

Stemless hellebores resemble small succulent peonies in foliage. Unlike peonies, however, they are perfectly evergreen, even in our severe Rocky Mountain climate. Although Christmas roses are usually shorter and more apple green in foliage color than Lenten roses, they are similar in garden value and needs. Appropriately named, Lenten roses

tend to be at their peak of bloom at this season. Most of these resemble Christmas rose in flower size.

Flowers tend to be less waxy, and most are deeply dotted, slashed, spotted or speckled with pink and purple. Some are deep purple. Their foliage is usually deep, glossy green with sharp, dentate margins rather than the gentle lobing of Christmas rose.

Lenten roses are primarily plants of the Balkan Peninsula and mountains surrounding the Black Sea, where 253 summers are dry and warm and winters cold—a climate similar to that of the High Plains. Given a relatively cool exposure, Lenten roses are vigorous plants here, often self-sowing into drifts with a broad color range. In February and March they are a gardener's delight.

Stemless hellebores may be propagated by division or from seed but both techniques are frustratingly slow. Instead of lifting and dividing as with most perennials, the best way to divide hellebores is to pry off one or two large pieces of the plant from a large clump, making sure that the mother plant is not unduly disturbed. The division should contain at least seven leaves with much of the root and soil intact.



Helleborus orientalis

They should be replanted promptly, watered and carefully mulched. This is best done in late spring although it can be done safely throughout the growing season. Even with great care divisions may not bloom the next year. Hellebores, like peonies, are best considered as eternal perennials and should be placed where they can prosper for decades in a well chosen spot. Indeed, hellebores are probably more vigorous in our climate than most peonies, since they are shade-loving, carefree plants. Once established they invariably bloom.

Growing hellebores from seed is the best method for obtaining quantities of plants. However, most species have a double dormancy requirement with seeds needing two years to germinate. Thereafter, seedlings are easy to grow but slow to attain maturity. Using typical home-gardener methods of seed germination and culture, seedlings will seldom bloom in less than five years.

Stemmed Hellebores

The stinking hellebore, *H. foetidus* L., is a vigorous plant that thrives under partially shaded garden situations in Colorado. The large mounds



Helleborus foetidus

of finely divided, evergreen foliage are decorative at all times of the year. This foliage is responsible for the pitiful common name, since it does have an unpleasant odor if crushed; but it is worth growing for its foliage alone. The flowers—small, green and profuse—are not at all like the stemless hellebores. They are, quite simply, startling for they are produced in massive panicles throughout the winter months. Flower arrangers love the subtle and sophisticated flowers and even people who dislike green flowers find this dramatic display of bloom in midwinter to be fascinating.



Helleborus corsicus

H. lividus Aiton var. *corsicus* (Willd.) Tutin is an aristocratic garden plant from Corsica and Sardinia, which has been proven hardy in Colorado. Its huge masses of deep green, glossy, evergreen foliage resemble holly and the flowers, a brassy yellow, occur at the ends of long branched stems throughout late winter months. Easily grown in a variety of soils, here it prefers some shade during summer. Holly or Corsican hellebore can grow nearly 4 feet high, covering an area 5 feet across, strictly a plant for large gardens while other hellebores are suited for

any number of sites in Colorado gardens.

In nature, almost all hellebores are woodland plants and enjoy having compost and humus incorporated into their soil at planting time. They do not demand the light, leafmold soil so many woodlanders require. Once established all hellebores seem to thrive here in ordinary garden conditions and have considerable drought and heat tolerance.

The best way to obtain hellebores is to cajole a piece from a gardener friend. Local nurserymen are slowly building up stocks of seedlings. A few mail order perennial nurseries offer different species and cultivars. A nursery in Great Britain specializes solely in this genus.

The Christmas rose, and its glamorous relatives, awaken a garden while most flowers are fast asleep. □

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In Memory of Hudson Moore Jr.

With the death of Hudson Moore Jr., Denver Botanic Gardens has lost a most faithful member, charter trustee, and life trustee who continuously served on the Board since the Gardens' incorporation in 1951.

We are indebted to him for his considerate and wise counsel during our early years of development, especially during the 1950s and 1960s. A man of tremendous talents and capability, he was involved in many activities in business and civic service; we were fortunate that he could find time to participate in much of our policy making and general planning. Those who served with him will remember how often he would crystallize the thoughts of his fellow trustees into productive decisions by saying, "Always remember our corporation is an agent of the City and County of Denver with assigned responsibilities."

Our Board of Trustees and loyal members have endeavored to satisfy



1906-1983

this directive and must pledge to continue to develop Denver Botanic Gardens and maintain our institution to the highest standards of quality.

To his family we express our appreciation for sharing him with the Gardens, and for suggesting contributions be made to Denver Botanic Gardens in his memory. MLS

Transplanting Big Sagebrush for Reclamation

Kathy Falkenberg

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Until recently, most research on big sagebrush (*Artemisia tridentata* Nutt.) was for the purpose of eliminating it from western rangeland. Its range includes at least 150 million acres in Colorado, Wyoming, Utah and a half dozen other Western states. It is an aggressive invader, moving in on overgrazed or otherwise disturbed land, and it has low palatability for livestock.

Although the battle between ranchers and big sagebrush is still waging, interest has increased in utilizing this very competitive and successful shrub instead of fighting it. Studies on germination, variation in palatability between subspecies, and its use as winter forage by big game have resulted in the use of big sagebrush in restoration of big game range. It has also been used to a limited extent in surface mining reclamation in the semi-arid West.

On-going research continues to reveal the importance of native shrubs in wildlife habitat and semi-arid ecosystems. It has spurred greater interest in shrub reestablishment on mining disturbances. Work towards this goal has been accelerated by the advent of better equipment and technology, and the impetus of new government reclamation regulations.

One alternative for shrub reestablishment that is beginning to receive attention is the use of mature transplants. The transplants are dug from surrounding vegetation, usually from areas which will subsequently be mined. They are moved onto the disturbed sites using a backhoe, tree spade or modified front-end loader. Mature transplants can be especially useful in critical or hard to reclaim areas. They provide a rapid restoration of shrub cover and browse for wildlife, contribute to soil stability and help reestablish the natural cycling processes of plant communities. Besides being already adapted to the location and climate, critical soil microorganisms and other plants growing in association with the transplants are also moved. The result is a source of diverse organisms which will promote the rapid development of native plant cover on mining disturbances.

In 1979, a cooperative effort between industry and one government regulatory agency, the Bureau of Land Management in Rawlins, Wyoming, began. A study was initiated to determine the feasibility of using big sagebrush transplants to alleviate mining disturbance on antelope winter range in south-central Wyoming. Because big sagebrush is an important part of the pronghorn antelope winter diet, it was considered a key species for reclamation in this area.

The study was designed to simulate two different degrees of soil distur-

Kathy Falkenberg received the bachelor's degree in biology from Smith College, Northampton, Mass., and the master's degree in plant ecology from Colorado State University, Fort Collins.

bance associated with mining. Spoil piles, the displaced materials between mineral layer and the surface, have severely mixed soil horizons. This situation was simulated by excavating a pit 10 feet deep, temporarily stockpiling the material, then replacing it, and re-applying topsoil, much as it is done in mining. Compaction, caused by haul roads and facility sites, is a serious reclamation consideration. Ripping the compacted soil to about a 24-inch depth and re-topsoiling was the reclamation method used for this study.

Besides two soil simulations, four additive treatments were tested to see their effect on transplant survival. All transplants initially received 5-10 gallons of water plus a commercially available hormone solution to reduce transplant shock. Treatment one received only this. The other treatments also included 2) phosphate fertilizer (0-46-0); 3) irrigation; 4) fertilizer and irrigation; 5) snowfencing. In addition, plants were transplanted in both the spring and fall to see if there would be a seasonal influence. A 44-inch tree spade was used to move 640 big sagebrush.

Study Results

Big sagebrush was a very successful transplant on this site. After three years, there was 100 percent survival, which, under field conditions, is remarkable. On the average, canopy cover is increased 178 percent. This is an important development because shrub cover is a criteria in determining reclamation success.

Floral branch (inflorescence) production also increased considerably. Originally, there were less than 20 per plant. At the end of the second growing season, there were



Big Sagebrush

about 234 per plant. A further increase to 830 inflorescences per plant by fall of the third growing season suggested that the flush or reproductive growth was not merely a response to transplanting trauma. In addition, germination tests showed an increase in viable seed production.

Transplants did well in both soil simulations and none of the additive treatments showed a marked advantage over the treatment with no additives. Fall transplants showed an initial advantage for both canopy cover and inflorescence increase. This is probably due to time of transplanting. By May when the spring transplants were moved, active growth processes had begun. Suddenly reducing the water absorbing capacity of the plant would interrupt this activity and give the fall transplants several months advantage.

After the second growing season, however, the seasonal disparity decreased to such an extent that average increase in canopy cover was very similar: 184 percent for the spring transplants and 173 percent for the fall transplants.

One benefit of increased seed production was the rapid invasion of big sagebrush seedlings. After three years, density and shrub cover were compared between the native vegetation and the transplanted area. Although the number of shrubs per acre was 45 percent less in the study area, shrub cover was greater than in the native vegetation.

In terms of reclamation, this was a very successful study. It demonstrated that only three years after reclamation with big sagebrush transplants, shrub cover can exceed that found originally on the site. Big sagebrush has remarkable potential for rapid reclamation of wildlife habitat.

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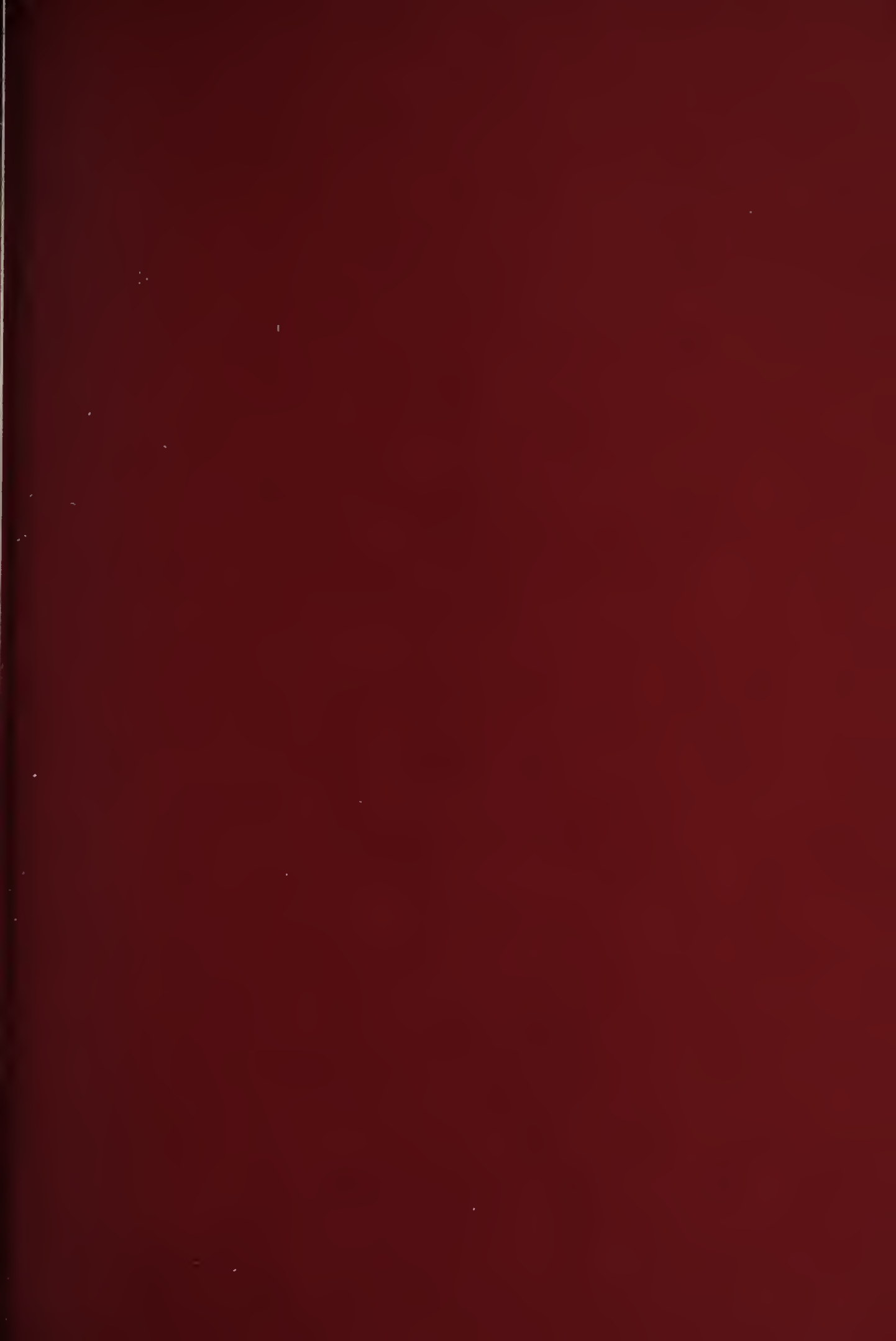


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The Green Thumb



Spring 1984

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Number One



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Frances Frakes Hansen

The Green Thumb

Spring 1984

Vol. Forty-one, Number One

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Velma A. Richards
Editor

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Denver Botanic Gardens, Inc., maintains a collection of living plants, both native and exotic, for the purpose of acquiring, advancing, and spreading botanical and horticultural knowledge.

This is a non-profit organization supported by municipal and private funds.

The Green Thumb — 40th Anniversary

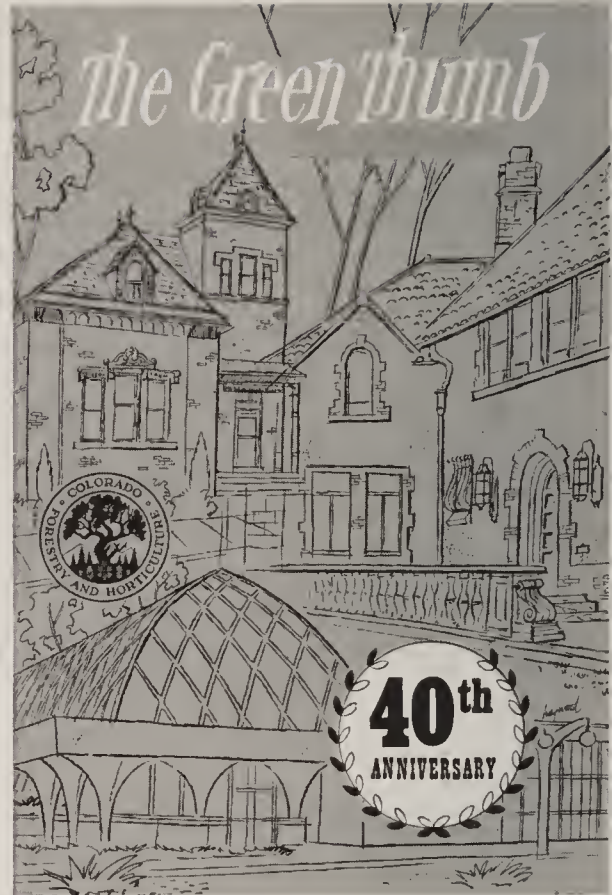
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It's our 40th Anniversary celebration. Each issue of the magazine during 1984 will review briefly one decade in the life of *The Green Thumb*: its contributions toward development of Denver Botanic Gardens and timeless horticultural information valuable for this area.

In February 1944 the Colorado State Forestry Association, which dates its beginning in 1884, and the Denver Society of Ornamental Horticulture, fathered by S. R. DeBoer in 1916, fused to become the Colorado Forestry and Horticulture Association. The two organizations embraced many of the same people; both served the love of growing things, and they foresaw that their combined energies would more than double their effectiveness.

Volume 1, No. 1 *The Green Thumb*, an eight-page bulletin, announced a conference February 26, 1944 to form the new organization and listed a 12-point program of activities. First among them were publication of a monthly or bi-monthly bulletin or newsletter for members; publication of educational leaflets on subjects in our field which would fill a popular need in this region; take the initiative in promoting a Rocky Mountain Botanic Garden; and

In this 40th Anniversary issue the Editorial Committee reviews *The Green Thumb*'s first decade with a bit of history taken from Elinor Kingery's *The First Twenty-Five Years*, Winter 1969. It excerpts some philosophy about botanic gardens from Vol. 1 No. 1, by two of Denver Botanic Gardens' founders, S. R. DeBoer and M. Walter Pesman, both landscape architects and immigrants from



establish an office as headquarters of the Association and employ an executive on a part-time basis.

At that 1944 meeting of CF & HA, Gladys Cheesman Evans (Mrs. John) largely responsible for its formation was elected president, and in 1946 the Association moved into a quaint Victorian house at 1355 Bannock Street, provided by Mrs. Evans. Horticulture House was the magazine's home until 1959 when

Holland; praises Winter Jasmine, an Exotic considered by Helen M. Zeiner in our Silver Anniversary issue; and offers horticultural expertise in an *All-White Perennial Garden* by Helen Fowler from Vol. 9 No. 2.

We trust you will find pleasure in this glimpse at our beginnings.

BEP

the Association headquarters was transferred to Botanic Gardens House, given by another generous-hearted woman, Ruth Porter Waring (Mrs. James J.).

George W. Kelly volunteered to edit the magazine when it was first suggested and after a year was persuaded to take on the job full time. He was also named executive director and official horticulturist. Of those early days he wrote: "There was much work, some fun, some disappointments, and great challenges in the work." For twelve years Mr. Kelly coped with the challenges, did the work, enjoyed the fun and endured the disappointments.

Devoted in its entirety to Victory Gardens, Issue No. 2 was an educational and membership tool — 10,000 copies were distributed. During the ensuing decade articles or issues covered lilacs, roses, natives, — the gamut of horticultural experiences with trees, shrubs, landscaping in this area. There were humorous discussions as well as

many serious ones on conservation, needs for botanical research and preserves.

According to Mr. Kelly the magazine thrived because of the efforts of really dedicated people who believed in its purposes. M. Walter Pesman said, "We may well claim that all the local authorities in horticulture, and a number of national experts had a share in making it outstanding."

Mrs. Evans, president until 1952, stated, "Its issues are replete with information of value to all those interested in our objectives."

In 1951, Mrs. Evans had been elected president of the Botanical Gardens Foundation of Denver and announced that Mr. DeBoer had been commissioned to draft plans for a 100-acre Botanic Garden surrounding the Denver Museum of Natural History at City Park. Fred Johnson, a retired forester, became president of CF & HA, and activities for both organizations were reported in the magazine.

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Proper Time to Start an Arboretum

M. Walter Pesman

The plans for the Washington Arboretum were drawn in March, 1936; in a way it is a 'depression-child,' the Works Progress Administration furnishing \$800,000 as a relief measure. . .

Here is a pretentious 267-acre public arboretum partly owned by the City of Seattle, under a perpetual lease to the University of Washington, partly owned by the State of Washington, developed to a large extent by Government funds (more than a million dollars has been spent on it),

and run by a non-profit corporation, the Arboretum Foundation; membership is open to all who wish to help. The City has agreed to maintain roads and paths, light and water facilities and to police the tract.

The University of Washington accepted administrative control and has complete supervision, also carrying on scientific studies. The Foundation maintains an office, meets the bills, and looks after the publicity . . .

Is it worth while? Arboretums are among the famous tourist attractions. Think of the Arnold Arboretum in lilac time, North Carolina in magnolia time, the University of Washington Arboretum is constructing a mile-long Azalea Trail.

Kew Gardens carried on the rubber experiments which resulted in the plantations now in Japanese hands. The Arnold Arboretum has done much to introduce Far-Eastern plants into the United States.

What will the Rocky Mountain Arboretum give to the world?



THE GREEN THUMB

VOLUME 1, NUMBER 1

FEBRUARY — 1944

The Colorado Landscape

S. R. DeBoer

... in this Rocky Mountain land a type of plant life has found a home which is sturdy enough to withstand the chills of winter and the wither of drouth. It seems, to me at least, that nature is adjusting its plant children here, with reduced spending facilities in a smaller leaf surface and with a greater sturdiness for work in its greater root activity. As time goes on, these qualities will become valuable assets in the commercial growing of plants and the Rocky Mountain land will fill an important place in furnishing the nation with sturdier trees and plants. It is already doing it with such plants as sugar beets, melons, celery, carnations, wheat and many other items.

The narrow valleys of Colorado have a type of landscape which is opposite of the broad plains and level landscapes of other parts of the nation. Add to this a type of plant life which is typically Rocky Mountain in character and you have what I believe is the present and the future of the Colorado Landscape. It is different. It dares the man from other states to understand it, to work with it successfully. Landscape and landscape design in this section must be understood to succeed. It requires not only intensive study of the region's plants, its climate, its ways of plant maintenance, but it needs more than that; it requires an understanding of the Landscape of the Rockies. It can be taught nowhere but here.

All White Perennial Border

Helen Fowler

It is but a few years ago since one-color borders were receiving various tryouts. Unfortunately they were used as main borders of the home grounds, with usually disappointing results. A section of a large garden planted to an all-white border could have more distinction and variety than might be supposed. The effect is cool and quiet and a pleasant place at night. A background of evergreens would be most effective, and gray-foliage plants such as arabis, dianthus, cerastium (snow-in-summer) and others, both tall and dwarf, should never be omitted. A stone wall makes a nice enclosure with trellises, arbors and seats, which could be made best of wood and painted a silver-gray, or, if preferred, allowed to weather.

If *Helleborus niger* can be considered a spring flower, then this Christmas rose comes first: here in the Rocky Mountain area it overlaps from winter, but it should never be planted unless in a well-protected spot.

The spring overture includes a few minor bulbs, such as crocus and galanthus, snowdrops, followed closely by one grand opening chorus selected from tulips, hyacinths,

daffodils, *Arabis*, rock cress; *Erinus*, figwort; *Phlox subulata*, creeping phlox; *Primula*, primroses; *Iris pumila*, dwarf iris; and *Violas*, violets.

In the wings waiting are columbine, dutch iris, painted daisies and elder daisies. The white Oriental poppies bloom at this time, but you will not like their sick look. June follows with roses, peonies and delphiniums and July brings the lovely phloxes and Shasta daisies. Not many whites are found in the chrysanthemum group, but plenty if planted with the tall, hardy asters — 'Mt. Everest', 'Sam Banham' and 'Climax'.

If gardens are properly cared for — dead blooms removed, soils kept loose and moist, and if a little spraying is done (especially on roses and delphiniums), then continuous bloom may be had from May, sometimes even April, until heavy frost. We spray roses to ward off attacks of diseases and insect pests. . . .

In the following lists, only the white-flowered forms of the plants are intended so Latin variety names are omitted.

For many years Mrs. Fowler owned Shadow Valley Gardens at West 44th Avenue and Kipling in Wheat Ridge, where she maintained one of the largest collections of perennials available in this area. Now, some 25 to 50 years later, local gardeners still prize distinctive perennial borders planted by her.

Mrs. Fowler was a founder and dedicated member of CF & HA. When a Denver Botanic Gardens was initially developed near the Denver Museum of Natural History she gave a treasured collection of 100 ferns. Her personal library of more than 500 volumes was the nucleus for the Helen Fowler Library begun in 1947 at Horticulture House. Besides books and

funds to establish a horticultural library, she provided enthusiastic leadership and stimulated others to give, not only rare and valuable books; they donated and raised thousands of dollars for continuing growth, to assure a library worthy of national recognition.

This reprint, typical of dozens of articles written by her over the years, appeared in *The Green Thumb*, Feb. 1952. No doubt newer and hardier plant varieties have been developed, but her recommendations would be basically successful in today's borders. Common names have been inserted to ease the translation. Unfortunately, they vary with geographic areas.

BEP



Highbush cranberry

Shrubs or Small Trees to be Used as Accents or Background

Spring-Flowering: *Exochorda racemosa*, pearl bush; *Philadelphus virginialis*, *P. coronarius*, mockoranges; *Prunus glandulosa*, flowering almond; *Spiraea arguta*, *S. prunifolia*, *S. thunbergia*, *S. vanhouttei*, spireas; *Viburnum lantana*, wayfaring-tree.

Summer and Autumn Flowering: *Hydrangea* 'A.G.', *Rosa multiflora*, *R. rugosa*, *R. spinosissima*, Scotch rose; *Sambucus canadensis*, elderberry; *Syringa*, lilac, many varieties; *Viburnum trilobum*, highbush cranberry.

Plants for Use at Back of Border

Summer-Flowering: *Althea rosea*, hollyhock; *Aruncus sylvestris*, goatsbeard; *Macleaya cordata*, plume poppy; *Campanula*,

bellflower, several; *Cimicifuga racemosa*, *C. simplex*, snakeroots; Delphinium; *Filipendula*, sometimes spirea, several; *Thalictrum aquilegifolium* and *T. dipterocarpum*, meadow rues; *Valeriana officinalis*, valerian.

Fall-Flowering: *Aster*; *Boltonia asteroides*, false camomile; *Chrysanthemum uliginosum*, giant daisy; *Phlox*, several; *Hibiscus*; *Valeriana*.

Plants of Medium Height

Spring and Summer Flowering: *Aquilegia vulgaris*, columbine; *Achillea*, yarrow; *Campanula*, bellflowers, several; *Chrysanthemum maximum*, Shasta daisy; *Clematis recta*, upright clematis; *Dianthus barbatus*, sweet William; *Dictamnus*, gas plant; *Gypsophila paniculata*, baby's breath; *Hesperis matronalis*, dame's rocket; *Heuchera*, coralbells; *Iris* (bearded), *I. siberica*, *I. spuria*; *Linum*, flax; *Lobelia*; *Lupinus*, lupine; *Polemonium*, Jacob's ladder; *Penstemon digitalis*, foxglove beardtongue; *Physostegia virginica*, false dragonhead; *Platycodon*, balloon flower; *Veronica*, speedwell.

Fall Flowering: *Anemone japonica*, Japanese anemone; *Aster*; *Eupatorium*, boneset; *Hosta*, plantain lily.

Low-Growing Plants for Foreground

Spring-Flowering: *Aquilegia flabellata nana*, a dwarf columbine; *Arenaria montana*, sandwort; *Arabis albida*, wallcress; *Asperula odorata*, sweet woodruff; *Convallaria majalis*, lily-of-the-valley; *Dianthus deltoides*, maiden pink; *Epimedium macranthum*,

barrenwort; *Erinus alpinus*, figwort; *Gypsophila cerastioides*, a dwarf baby's breath; *Iberis sempervirens*, candytuft; *Iris*, dwarf varieties; *Myosotis*, forget-me-not; *Phlox subulata*, creeping phlox; *Silene alpestris*, alpine catchfly; *Statice armeria*, thrift; *Tiarella cordifolia*, foam flower; *Teucrium*, germander; *Viola*, violets.

Summer-Flowering: *Anemone sylvestris*, windflower; *Campanula carpatia*, bellflower; *Delphinium grandiflora*; *Erigeron*, fleabane; *Galium*, bedstraw; *Helianthemum*, sunrose; *Nierembergia rivularis*, whitecup; *Primula japonica*, primrose; *Scabiosa caucasica*, pincushion; *Sedum*, stonecrop; *Thymus serpyllum*, thyme; *Tunica saxifraga*, coat flower; *Papaver nudicaule*, Iceland poppy.

Autumn-Flowering: *Aster ericoides*, heath aster; *A. ptarmicoides*, upland aster; *Chrysanthemum arcticum*, Arctic daisy; *Papaver nudicaule*, Iceland poppy.

Spring and Summer Flowering Bulbs

Allium neapolitanum, daffodil garlic; *Camassia leichtlini*; *Colchicum autumnale* and *C. speciosum*, meadow saffrons; *Crocus biflorus* and hybrid crocuses, spring flowering; *Eremurus elwesi*, foxtail lily, 10-12 ft.; *Erythronium californicum*, fawn lily; *Fritillaria meleagris*, guinea-hen flower; *Galanthus*, snowdrop, species; *Hyacinthus*, double and single; *Leucojum aestivum*, *L. vernum*, snowflakes; *Lilium auratum*, *L. candidum*, *L. regale*, lilies; *Narcissus*, daffodils, many varieties; *Ornithogalum umbellatum*, Star-of-Bethlehem; tulips, many varieties; *Scilla campanulata*, squills.



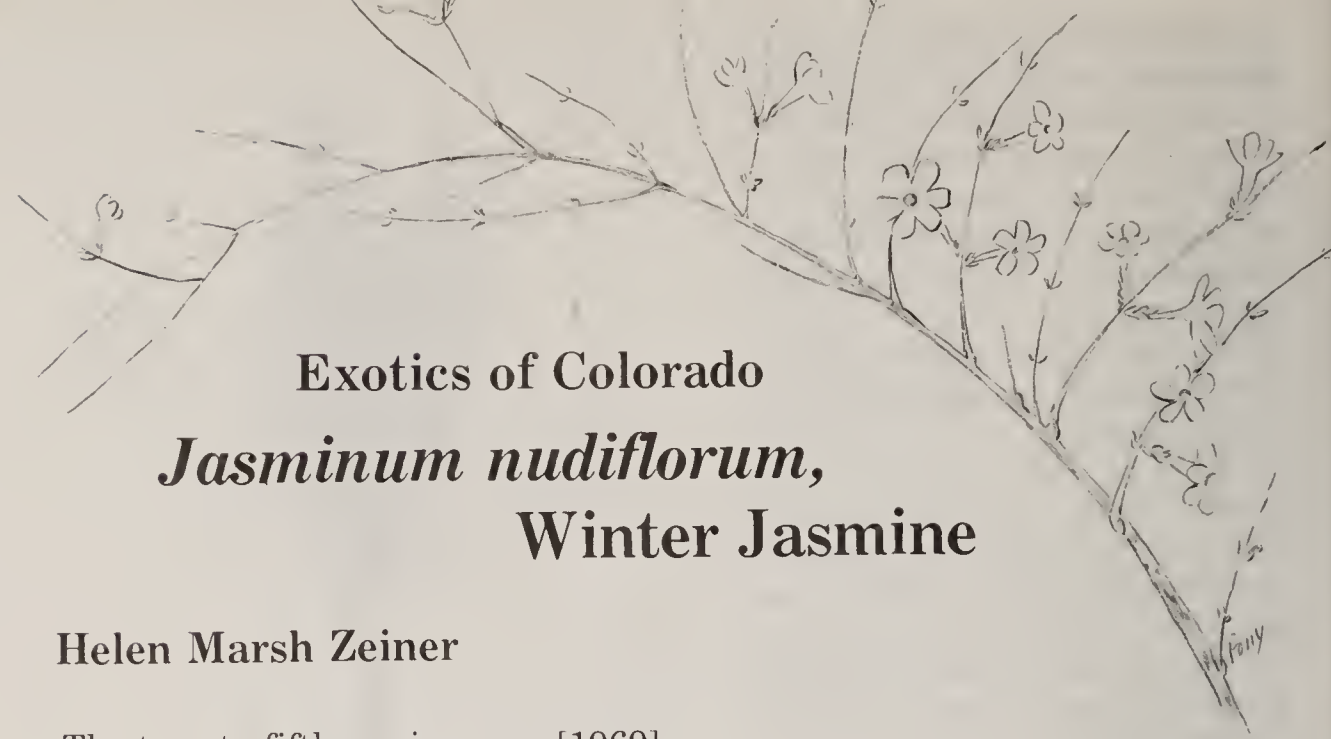
Lily-of-the-valley

Summer-Flowering Bulbs, Tubers, Corms to be Planted in Spring

Dahlia, tall and dwarf; *Gladiolus*; *Galtonia candicans*, summer hyacinth; tuberoses, double and single.

Climbers: *Clematis*, Duchess of Edinburgh, *C. montana*, *C. paniculata*, *C. veitchiana* (this white has a touch of yellow); *Lonicera halliana*, Hall's honeysuckle; *Lathyrus latifolius*, hardy sweet pea; *Polygonum auberti*, silverlace; roses, many varieties.

Annuals for Summer Flowering: *Antirrhinum*, snapdragon, tall and dwarf; *Aster*, tall and dwarf; *Bellis*, daisy; candytuft; sweet sultan; cornflower; *Clarkia*; *Cosmos*; Chinese pinks; *Godetia*; *Gypsophila elegans*, baby's breath; larkspur; mignonette; *Nicotiana affinis*, flowering tobacco; pansies; petunias; *Phlox drummondii*; poppies; sweet peas; stocks; verbenas; zinnias.



Exotics of Colorado

Jasminum nudiflorum, Winter Jasmine

Helen Marsh Zeiner

The twenty-fifth anniversary [1969] of *The Green Thumb* inevitably brings to mind Horticulture House at 1355 Bannock Street, where so many years of *The Green Thumb's* history was made — and who can remember Horticulture House without remembering the winter jasmine that grew in such profusion along the fence?

Jasminum nudiflorum Lindl., winter jasmine, is one of the most interesting exotics grown in Denver, largely because of its habit of blooming during the winter months.

Almost any time from November onward, depending on the weather, winter jasmine may burst into bloom. There is nothing more delightful, on a winter's day, than to come upon a winter jasmine with its yellow flowers scattered like golden stars along the otherwise bare green stems.

At the first sight of a winter jasmine

in bloom, you will probably think of forsythia. In both flowers and stems, jasmine does resemble forsythia. This is a natural family resemblance, for the genus *Forsythia* and the genus *Jasminum* both belong to the family *Oleaceae*. Some other well-known members of this family do not show their relationship in quite such an obvious manner, but a closer study shows that they have much in common. These plants include *Syringa*, the lilac; *Ligustrum*, the privet used so frequently as a hedge plant; and *Fraxinus*, the ash, a common and desirable street tree in the Denver area.

Although jasmine is similar to forsythia in several ways, it is a more sprawling shrub than most forsythias. It is classed as a shrub, but it is sometimes aptly called a half shrub-half vine. Jasmine does not climb but needs some support, and it is suggested that it be grown

Helen Marsh Zeiner, Ph.D., curator of Kathryn Kalmbach herbarium and former professor of botany at the University of Denver, has contributed many articles for *The Green Thumb*. Her first, "Consider the Ornamental Grasses," appeared in June, 1950.

Polly Steele's botanically accurate drawings and lively cartoons graced the pages of *The Green Thumb* for more than 25 years and are repeated in this 40th anniversary issue.

on a fence or wall.

A well-established *Jasminum nudiflorum* will send up many slender upright green branches which arch and grow downward to the ground, where they may take root. This results in a tangled growth, and in the south, where the plant thrives, it can produce real thickets.

Some pruning will be needed to keep the plant under control, but use discretion — several Denver gardeners report killing their winter jasmine by cutting it back too drastically.

Because the flowers are produced on last year's branches, prune as soon as convenient after flowering. This gives the shrub an entire season to grow new branches which will be the flowering wood.

Winter flowers are the main reason for growing this exotic, and, like forsythia, it is not an outstanding shrub during the summer, but neither is it unattractive.

Winter jasmine has small three-parted compound leaves, arranged in an opposite manner along the stems. Each leaflet is oval to oblong, narrow at the ends, and about half an inch to an inch long. Leaf stalks or petioles are very short.

The bright yellow flowers are usually about an inch across. They have six petals, spread so that they give a star-like effect. Flowers are borne one in a place on very short stalks, and thus appear to arise directly from the stem.

The genus *Jasminum* is said to produce some of the sweetest-scented of all shrubs. The flowers of *J. nudiflorum*, however, do not have a marked fragrance.

A black, berry-like fruit may be produced.

Jasminum nudiflorum is a native to north China. It was introduced from China in 1844, primarily because of its winter-blooming habit.

The genus name *Jasminum* is derived from an Arabic word for jasmine. Jasmine, jasmin, and jessamine are all derived from this Arabic root, all are common names for members of the genus *Jasminum* and other genera of sweet-smelling plants. "*Nudiflorum*" means naked flowers.

Winter jasmine will grow well in Denver, but it does need protection, at least until it is well-established.

At Horticulture House, *Jasminum nudiflorum* grew against the south side of a high stake fence which ran along the north side of the lot. There was a narrow walk between the fence and the house, with very little other space. This provided a very sheltered spot between the high fence and the house, and winter jasmine flourished and produced its dainty flowers every winter for the enjoyment of those who used the walk.



Horticulture House

Small Space Gardening

Growing plants in small spaces is an activity appealing to many, whether within large gardens or on apartment balconies. The small garden may be a little space within a larger one, a patio area or balcony with a planter or trough, or a hanging basket, but it brings a special joy to the beholder. There is challenge and excitement in the creation of a beautiful small garden.

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In this issue of *The Green Thumb* are several articles concerning gardening in smaller spaces. In forthcoming issues additional articles in this vein will appear — some dealing with material planted in the ground, others with container gardening.

A profusion of color in hanging baskets or in troughs with mini-gardens of alpine plants delight those who visit a garden of any size. Most of the material pertaining to gardening in small spaces is applicable to and can be of interest to all who garden.

Take some of these suggestions, combine them with your own, and create something new within your own garden; visit Denver Botanic Gardens to enjoy and learn more about the subjects covered in these articles. Throughout the Gardens, and particularly at the new Morrison Horticultural Demonstration Center, discover fresh ideas to create your own garden in a small space.

Editor



Hanging Gardens

Karen Anderson

Hanging gardens can be the most eye-catching of all floral displays. Hung from a deck, patio or tree, a hanging basket can accent the rest of the garden, or serve as a garden in itself. Be prepared to give them proper care; hanging gardens are not for the forgetful or lazy gardener.

Any container will make a hanging garden if provided with a way to hang it; but consider how fast its material will dry out. Exposed to air currents on all sides, it will lose moisture more rapidly than a container set on the ground. Clay or terra cotta containers require careful watering. Unfinished clay with many pores lets moisture from the soil evaporate easily. Glazed ceramic pots are non-porous, but are heavy and brittle, as is clay. Secure them well as a wind-aided fall could shatter them and destroy your entire arrangement.

A wire basket lined with dried sphagnum moss needs water often. The inner layers of moss, in contact with the moist soil, will sometimes decompose leaving a thin shell to protect roots that may grow into the moss and very close to the drying air. Wood will absorb moisture and provide a temporary barrier between the dry air and moist soil, delaying the drying of the soil by evaporation. A compressed cardboard liner used with a wire basket acts much the same and makes a good hanging container. Plastic keeps moisture in the soil and is lightweight; watch out

for overwatering especially during damp weather. Always have a drainage hole in the container. It signals when the soil ball is wet all the way through, as well as helping to avoid root rot from water setting in the bottom of the container.

Remember also that a large container has more soil volume per surface area than a smaller container and so dries out more slowly.

A loose, well-drained potting mix is best for planting. Among many mixes available at local garden centers, look for one containing sphagnum peat for water retention and perlite or vermiculite for aeration. A little coarse sand mixed in equal parts with sphagnum peat or decomposed compost and good garden soil makes a good mix. Avoid clay soils at all costs. Check yours by taking a handful of slightly damp soil and gently squeezing it in your hand. If it stays in a lump when flicked firmly with a finger it has too much clay for this purpose.

Regular watering is important. Don't worry if the plants wilt once in a while, though. A slight wilting temporarily delays growth, but beware of letting it go too far. There is a point, the permanent wilting point, at which plant cells will not refill with water even when it is supplied. At this point the cell walls have collapsed and nothing will revive them. To ensure wetting the entire soil ball, flood the surface to make sure there are no dry areas, and keep on until the water runs out the drainage hole in the bottom. When the container is freshly planted, pay particular attention to the plants

near the edge until they are well-rooted, for they will dry out faster than the rest of the plants.

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Because frequent watering often leaches nutrients from the soil, a regular fertilization program is necessary. Avoid mixing fertilizer into the soil before planting; it is easy to burn young roots with an overdose. Mixing a soluble fertilizer such as Peters, Miracle Gro, K-Mart special or others into the water once a week should keep flowers blooming consistently. A good analysis is 14-14-14, but any formula in that range will do. If you can't find a balanced fertilizer with all three numbers equal (nitrogen, phosphorus, and potassium), a fertilizer higher in phosphorus (middle number) is as good or better. Phosphorus is the nutrient most responsible for promoting bloom as opposed to nitrogen for leafy, lush growth and potassium for strong stems and roots. A slow release fertilizer such as Osmocote is the best yet. Spread on top of the soil, the granules release a little fertilizer with each watering. It lasts anywhere from two to three months, breaking down faster under hotter temperatures. A slight decrease in abundance of bloom indicates fertilizer is depleted.

Disease problems are few with container gardening, aside from root rot or stem rot from soil that stays constantly wet, or powdery mildew in humid areas. Powdery mildew will first appear as a graying of the leaves followed by a white powdery coating. Left unchecked, it will yellow and eventually kill the plant. If caught early, it can be controlled with applications of a systemic fungicide such as Benomyl. The powdered fungicide, mixed with water and



sprayed on the foliage, is absorbed to control mildew and provide future protection for the plant. Phlox, zinnias and Irish lace marigolds are often affected.

Spider mites and cutworms are generally the only pests causing plant damage. Spider mites seem to appear from nowhere and multiply freely. A yellow, stunted appearance indicates their possible presence; tiny dots with or without webbing on the back of the leaves will confirm it. Spray must be applied two or three times, five to seven days apart, making sure to coat the undersides of the leaves as this is where the mites are present. Watch for them especially on marigolds and verbenas.

Cutworms appear in July or August from eggs laid in the soil by moths earlier in the year. Tiny to begin with, they often escape notice until they are large enough to cause drastic damage. Watch for ragged or torn blooms on petunias (their favorite) when there has been little wind or hail. When a little larger, the worms will destroy the leaves at an alarming rate. For visual confirmation look first in the throats

of the blooms and around leaf axils. While small, the worms usually hide there when not feeding. When larger, they tend to hide in the soil during the day and feed at night. Sometimes water will chase them out of the soil and up a nearby stem where they can be plucked off. Since a grayish-green worm is hard to spot among plant stems, spraying may be required.

Many insecticides that will control both mites and caterpillars are available, but some can be dangerous to your health. An insecticide made from natural pyrethrums is quite effective, non-harmful to humans and often available in local garden supply outlets. For best results, spray for cutworms at night when they are out feeding.

For maximum bloom, trim the plants every week or so, removing all the faded flowers down to the stem before they produce seed. An annual flower's life cycle is germination, growth, bloom, seed and death. Once it has produced an abundance of seed, it will cease blooming. Also, pinch a few stems back with each trimming to keep the plants from getting straggly and having to be cut back all at once.

What plants do you want to use? For an accent, containers of one or two kinds of plants are suitable. Fuchsias, tuberous begonias and ivy geraniums are all good accent plants; but it is better to purchase these ready-made from a greenhouse as they take quite a while to fill in and bloom. For planting your own, try petunias, portulaca, thunbergia, lobelia, browallia, coleus or impatiens. For a really full basket and a riot of color, make what is commonly called a "French Garden" of mixed flowers. Yes, it can look messy if it is just thrown together, but a little time and planning can give a glorious display.

When planting a "French Garden" consider first its location. Is it sunny, filtered shade or half a day sun and half a day shade? Is it a hot spot over asphalt or concrete, or is it over a cooler grass area? With only consideration for limitations of light or temperature, the choice of plants is entirely up to you. Do experiment a little. When my baskets have grown for a season, I like to make a note of what did well in each location to give clues to make them better each year. Your nursery or greenhouse can advise which plants like sun or shade, grow upright or trail over, stay short or grow tall — or you may refer to the list included of my favorites.

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When planting begin with a container about half to two-thirds full of soil. Then select plants that will either drape over the side as lobelia or alyssum, or plants that grow upright and stay fairly short as ageratum or dwarf marigolds. Sometimes a plant that normally grows upright can be forced into cascading over the side by pinching its main stem when very young. This causes the plant to have many weak stems instead of one strong stem and the plant's own weight causes it to hang down over the side. Pixie snapdragons do this well.

Once the rim is filled, start a second row of slightly taller, upright plants — maybe non-pinched snaps, verbena, or dusty miller. Toward the center use taller plants such as phlox and petunias. Some people use geraniums in the center, but they don't have enough bloom for all the room they require. They do make a good center filler though if you have extra room.

The root balls have now filled most of the space in the container. Using your hand or a cup, sift more soil into the gaps between the soil balls and

then press the plants down gently but firmly to settle them into place. Attach wires, or set the container in a macrame hanger. Now you have a hanging garden.

Are you wondering how many plants you will need? It depends on the size of the container and your patience. Make a circle with your thumb and forefinger. That is about how big the average root ball is on a bedding plant. Move the circle around the surface area of the container counting one plant per circle until the whole area is covered. This will give an estimate of how many plants are needed if you are a patient person. If you like a full garden right away, double the amount. Yes, your container will support all these plants. Just continue watering and fertilizing and each plant will find its own space and light.

Plants Suitable for Hanging Gardens

Lobelia — Red, dark blue, light blue, purple or white. Trailing. Will bloom from full sun to shade in Colorado. Blooms profusely through July. Browns out a bit in hot temperatures but if trimmed, will revive for September and October.

Alyssum — Purple, rose-pink or white. Will hang down in a mass of color if planted at the rim. Likes full sun or even a little shade.

Vinca vine — (*Vinca major variegata*) A green and white vine. Planted at the rim will eventually hang down 6 feet or more.

Ageratum — Blue or white. Short upright plant. Full sun to partial shade. Blooms some in shade in Colorado.

Marigold — Dwarf varieties. Yellow, orange variations. Yellow and Orange Boy are short varieties, but blooms are sometimes hidden in a crowded basket. Showboat is a

fairly short marigold with a larger bloom. Good for hot areas.

Dianthus — Mini carnations or pinks. Pinks, reds, white. Short upright or semi-upright for planting near the rim. Full sun to partial shade.

Verbena — All colors. Moderate height upright or semi-upright. Good for full sun and hot areas, but will bloom in partial shade.

Snapdragons — Pixie varieties. Most colors. Moderate height upright or draping if pinched young. Full sun is best but in cool areas.

Dusty Miller — Grayish white, moderate height, upright, grown for its silvery foliage. Can be used from full sun to full shade in Colorado.

Phlox — Pastel colors. Taller upright with clusters of delicate flowers. Full sun in cool areas or partial shade. Will bloom some in the shade in Colorado.

Petunias — All colors. Vigorous sprawler that will fill the center of a pot as well as mix with other edging plants. Full sun to partial shade.

Impatiens — All colors. Grows both upright and sprawling, like a petunia, but is one of the best flowering plants for shade.

Coleus — Multicolored plants grown for their foliage. Various heights and colors are available. Generally used for shade or partial shade but may be used in full sun in areas where the sunlight is not as intense as in Colorado.

Browallia — Blue or white. Moderate height upright for partial shade. Star shaped flowers. Will bloom some in shade in Colorado.

Chlorophytum — Spider plant. Green-white foliage plant often used as a house plant. Will grow in partial to full shade for foliage accent.

Asparagus Fern — Green lacy plant often a house plant. Will grow outdoors in full to partial shade. ♀



Espalier — A living art

As population in the high plains country increases and gardens diminish in size, dwarf and trained fruit trees are custom-made for terrace gardens or small courtyards. City and suburban gardeners can cultivate a greater choice of ornamental as well as edible plants within a restricted area by using dwarf stock and incorporating the technique of espalier.

Essentially, espalier is a method of training trees and shrubs against a wall or fence by pruning and bending to conserve space — seemingly two-dimensional and lacking depth. Plants can be trained into a variety of forms to provide a focal point on a broad expanse of wall, against a chimney, around a window where its fragrance can be enchanting, as a living fence or to screen unsightly objects. This type of plant discipline with its delightful patterns is an intriguing art.

Begin with a whip or sapling. When planting use good soil plus compost, peat or humus to a depth of at least 18 inches. If planting next to a building, be sure the builder's rubbish has been removed; if bentonite is your bane,

best you plant against a garden wall. Don't use fertilizer for at least a year.

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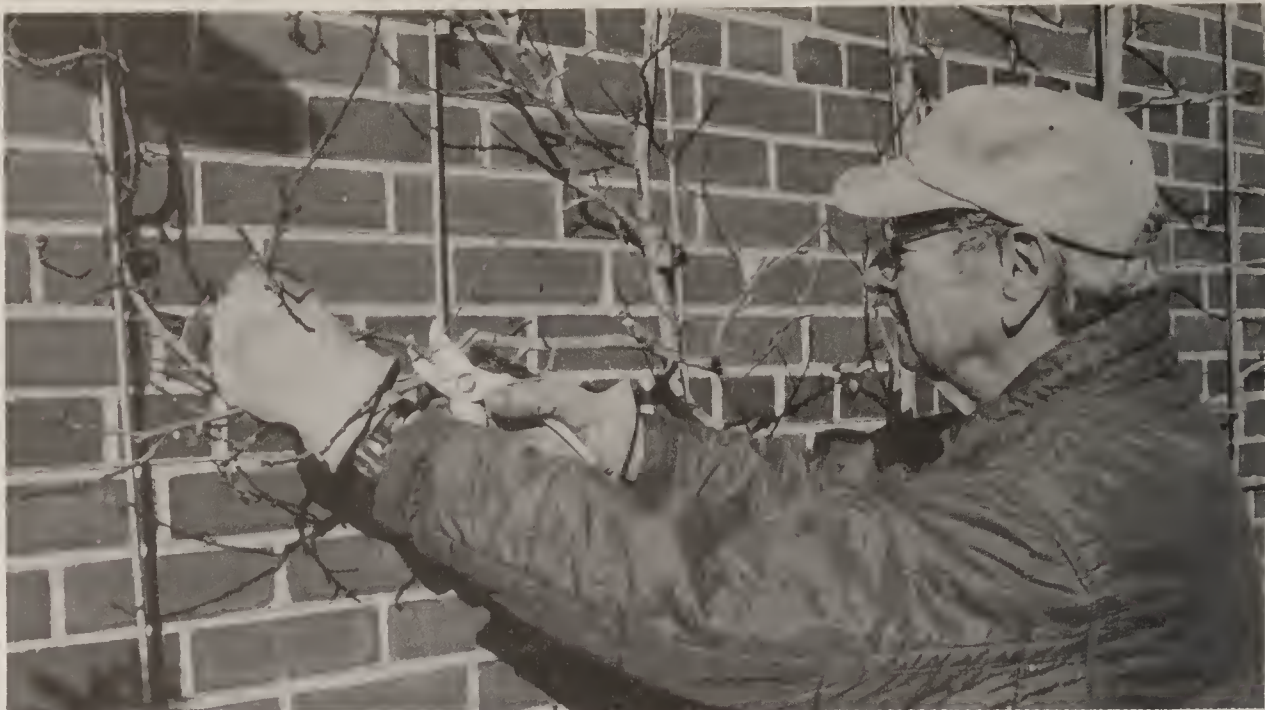
Local nurseries offer a variety of plants that adapt readily including purely aesthetic specimens of pyracantha and staked junipers. Leuthardt Nurseries in New York have offered a variety of pre-formed plants by mail for decades. A word of caution: If dwarf apples are your choice, those designated as having East Malling rootstocks lack hardiness here and should be avoided according to specialists who have grown dwarf or semi-dwarf varieties in this climate. They suggest buying from nurseries who produce trees for the midwest.

As for mechanics, most experts recommend building a framework of pipe or fence material, such as sapling or redwood, and leaving an airspace 6 to 12 inches from the wall. Some recommend spikes or flanges fastened into wood or brick and used with rubber, leather or cloth between the fastener and the branch to prevent bark injury. Although efficient, this method seems cumbersome. In areas where mildew is prevalent, no doubt this airspace is vital.

In addition to the personal account by Miles P. Markley, D.D.S., the material in this article is a compilation of ideas taken from those written by Bernice Petersen and from *Gardens for All*, November, 1983, by permission of the authors.

In our semi-arid environment Wayward Vine supports, available at most garden supply shops, are extremely satisfactory for they attach

Continued on page 18.



Dr. Markley prunes unwanted branches from a peach tree espaliered on a support network of aluminum rods. In the article

below he tells of his varied experience using this technique for outstanding fruit production.

Espaliered Fruit Trees

Our inspiration to try espaliers came when we toured Europe in a motor car through the summer of 1952. In France and Belgium we found fruit trees being grown against the walls of buildings, for protection and to conserve space. Some orchards were pruned and trained on wire trellises. A garden in Versailles, in conjunction with a horticultural school, where we visited several times since, has espaliers trained on the stone walls — trees bearing beautiful fruits, each protected by a paper bag. Low, 18-inch high trellis wires carry fruit bearing tree branches lining walks.

My personal experience in Denver from that date may both encourage and instruct others in this fascinating, protective and artistic form of gardening.

Peach trees grow well in Denver; but they seldom bear fruit, probably because blossom buds develop during

our usual February thaw of several weeks duration. Later in the spring severe cold fronts from the mountains then freeze the buds. The protection I describe holds them back and tempers their environment.

Three espalier peaches, a Hale Haven, a Red Haven, and an unknown bear fruit almost every year, protected by the structures that support them. The oldest and most prolific is on the north wall of our red glazed brick house. Another grows well on an east wall. It is shaded by a huge spruce until ten o'clock, then has until noon in full sun. It has looked like a Christmas tree decorated with orange-red balls. Its trunk comes through a hole cut in the edge of a flagstone walk. Growth expansion eventually had the effect of girdling the trunk, so I enlarged the hole with a chisel. This year it bore a nice crop again.

The third dwarf peach thrives under



This fan-styled espalier, a Meteor cherry, trained against a northeast wall at the Petersen home, presents a living

accent around the seasons—starkly beautiful in winter or with flowers, fruit and foliage.

the drip line and in the shade of a roofed garden seat. Its support is a wire fence. In 1983 it bore $1\frac{1}{2}$ bushels of beautiful peaches. Leaving them on until dead-ripe assured superior flavor. Most were frozen for winter eating with nothing added, except ascorbic acid (Vitamin C) powder to prevent browning. (They make one of the best desserts we know.)

A Delcon apple tree grew vigorously on the north side of our garage for years. It was not a dwarf and did not produce well. It has been replaced by a Stella dwarf sweet cherry not old enough yet to bear. But on that same wall, we had a superb crop this year on a North Star cherry. By hanging a bird net from the gable roof edge, the fruit was protected from robins until dead-ripe. Most of that crop, too, was frozen for winter desserts.

A white Concord grapevine covers and shades a south wall. Grapes start late enough so that they tolerate and

enjoy the south sun. Their perfume comes through a bedroom window when they are ready to eat.

Probably our prize espaliers are two pyracanthas grown on the east wall of our garage. Their profusion of bright orange-red berries makes a picture all winter outside a big window. This shrub does not normally tolerate Denver's climate well, but it flourishes in this protected environment. Migrating robins and grosbeaks come in the spring to strip the berries in preparation for new blossoms.

Our method of attachment to a brick wall may be unique. Case hardened cement nails into the mortar between the hard bricks support $\frac{5}{16}$ inch aluminum rods bent to the desired shape of the growing plant. Plastic ribbons which will never girdle the branches as they grow, tie them to the support rods. Eventually a tree needs little support. M.P.M.

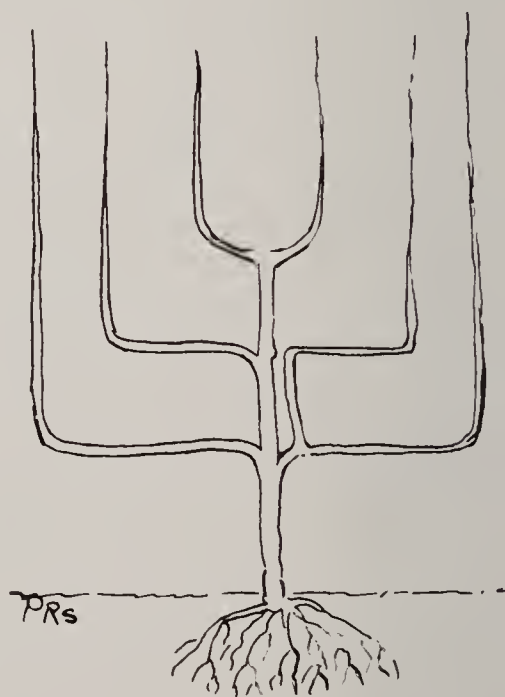


A. Begin with a whip or sapling. Cut back the top or leader to encourage branching. Leave three buds near the top—two opposite buds for the branches and the front one for the leader. B. Train two shoots on the horizontal support. Allow the central shoot to continue upward growth. Prune excess. C. At the end of the growing season start another horizontal tier by cutting back the surplus laterals from the main stem leaving three good buds again to form the central leader and two new horizontal arms. Prune shoots on horizontals.

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inconspicuously to brick or masonry. Carefully avoid choking a branch by gradually lifting the metal clasp. As branches enlarge, thread cord or nylon strips through the loops and around a branch. Actually, after a branch has been trained for a year or more it needs little support to retain a proper angle.

Successful development of an espalier requires patient training — pruning, bending, tying. Pruning cuts are determined by the form chosen, vertical or horizontal or combinations of the two, and by the species chosen.

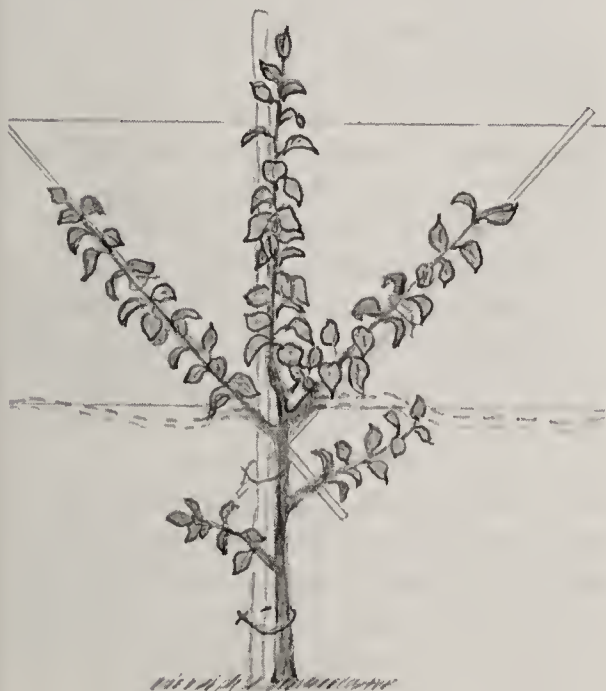


Sometimes a branch will develop close to the trunk on the next lower branch. This branch can be brought up parallel with the trunk and turned where the desired arm should appear. The substitution will be unnoticed.

Tips for Beginners

Gardens for All Newsmagazine (November 1983) suggests some basics for first-time espalier gardeners:

- Consider the pollination requirements of your tree. If it requires pollen from another tree or another variety, be sure one is nearby. Since flowering may be a bit earlier nearer a building, you may want to plant two espaliers to be sure there is pollen available at the right time.
- Each tree is unique. With patience, you can probably form almost any shape, but some will be easier than others. Look carefully at a young tree that has begun to branch and you might see that by removing a few branches and bending a few others you can easily get it going in the direction you want.



For more vigorous growth, lateral branches may be grown at 45 degree angles during summer and later trained horizontally.

- Pruning encourages growth of buds below the cut. Each time you cut back a leader, you remove its dominance, allowing buds below to grow. Winter pruning stimulates growth; summer pruning temporarily slows it. If a tree or branch is not growing well, cut it back during the winter; next year it should grow more vigorously.
- Vertical growth is more vigorous than horizontal. You can take advantage of this when training trees. Let horizontal branches grow at a 45 degree angle during the summer so they'll grow faster; You can bring them to the horizontal later in the season. If branches on one side of a tree grow faster than those on the other, bring the shorter branches up to a more nearly vertical position to help them catch up.

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For more information about plants suitable for the art of espalier and details for their cultivation, a list of references available in the Helen Fowler Library at Denver Botanic Gardens is included.

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Townhome or Condo Garden?

Check Carefully

Julia Andrews-Jones

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Multiple unit living can offer some surprises, not of the blooming sort, to the resident who loves to care for growing plants. Gardeners who move into townhomes and condominiums often want to have plants around them even though they may have come from a detached, single family dwelling with a garden whose maintenance may have become a burden. What could be nicer than a small garden scaled for less burdensome care?

The small garden in a terrace or patio area or in containers on an apartment balcony can be as enjoyable and as pleasing as a larger scale garden on a traditional city lot. There may, however, be some legal weeds this gardener may never have encountered before.

A townhome (you own the land upon which the unit sits) or a condominium (you own only the unit, not the land) in a park-like setting with someone else responsible for the maintenance seems an attractive alternative if the care of a large garden has robbed you of your pleasure with it. Living in units such as these is often represented as being carefree, but the gardener should ask some questions before signing a contract in order to prevent later disappointments, misunderstand-

ings, or a tangle of legal weeds.

The attractive, park-like setting of some of the developments is part of what you are buying. The landscape architect has carefully created a unified feeling and has developed the scale and detail in a complementary and consistent way throughout the community. The success of that design unity is part of the quality that you are buying, and perpetuating that quality becomes important to all the owners.

This is the basis for the rules governing what each owner is allowed to do on the outside walls or to grow next to the unit. Too much individuality can have a negative impact on the design unity, and this can lessen the perceived quality of the development.

The rules or prohibitions are in the declarations and bylaws of the association, and they vary widely among developments. Read these documents very carefully to see what is expressly forbidden and how that will affect any gardening venture you may have in mind.

In a townhouse, for example, you may own only a few feet of ground beyond the walls on the non-attached sides of your unit. There may even be no hose connections allowed on the exterior walls, and you may be required to hand water your plants.

How do you move in your favorite plants if only staff vehicles are allowed anywhere beyond the hard surfaces? Such a rule strictly enforced

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could mean that wheelbarrows and plant material would have to travel through your unit and across your carpet to get to your garden area.

In order to retain the design unity, there may be strict rules about plant species you may put in, and your favorites may not be on the list. The scale of your gardening project may also be affected by rules about trash and its disposal.

After you have read the rules, write down all the tasks involved in growing plant material at the scale you prefer. Then check the rules again to see if any step is expressly prohibited. When this exercise is completed, talking to a resident may clarify how some of the rules, or their interpretations, will affect your gardening venture.

When you know that your plants can be watered and maintained within the rules, check the exposure of your plot of ground. What time of day will it get the sun and for how long? Will it get the brunt of the prevailing winds? Does the exposure of your plot of ground suit the plants you intend to grow?

It is frustrating and self-defeating to try to grow hybrid tea roses where the reflected heat off white walls or off full length glass windows winter kills them every year. South facing masonry walls can change the temperature enough for plants to fail to harden off and therefore be more susceptible to frost damage. Are you going to be happy with the species which will be hardy in your new location?

If all of these questions have complicated the process of simplifying your lifestyle, be aware that another element may be added: the rules can change when the development passes from control by

the developer to control by the homeowners association. This happens usually when a certain percentage of the units are sold. Consider writing into your purchase contract any unusual or verbal permission from the developer.

If condominium living (where you do not own any ground) is your preference, and plants on the balcony are the extent of your gardening venture, there are still questions you need to ask before you assume that your creativity is the only limit to what can be done.

Are plant materials and their containers considered architectural and as such are covered by the rules for external architectural variances? Who makes the decisions about variances? Do the inside walls of your balcony come under exterior architectural control? Is a balcony devoid of plant material considered the standard of beauty for the development? In some places this is the effect of the regulations!

After the question "Can you do it on the balcony?" is answered, there remain the questions about exposure to wind and sun as well as those pertaining to plant maintenance. People who turn to gardening on a balcony after having had a garden in the ground will find vast differences, not only those of scale, but particularly those of new and different climatic conditions. Consider especially wind velocity on an upper story balcony.

All these questions may seem to complicate a change intended to simplify a lifestyle, but they can keep the gardener who intends to move into a townhouse or condominium from a legal weed patch more frustrating and entangled than any known to grow in the garden of the usual detached dwelling.



Integrated Pest Management in Urban Horticulture

John Brett

Insect and disease control are among the most difficult and frustrating problems facing gardeners. For every plant variety in the garden there are insects and diseases adapted to prey on it. Although some years will be worse than others, pest species will always be present.

Before World War II and the advent of modern chemical control measures a variety of strategies were used to combat insect and disease pests. The introduction of easy to use chemical pest control agents, which were highly effective in relatively low concentrations at fairly low cost, caused a wholesale abandonment of earlier techniques. Within a decade, however, weaknesses began to appear in what was thought to be the answer to pest control.

Insects and disease organisms can evolve quite rapidly because of their

short life cycle (often with several to many generations per year) and large populations. In a brief period of time many insects that had been readily controlled with light applications of a given chemical now required larger quantities of more toxic chemicals at more frequent intervals. The insects had evolved a resistance to the chemicals.

Other side effects, either ignored or not anticipated, were the non-selectivity of pesticides and the toxic residues from them. These pesticides affected beneficial insects as well as pest insects thereby reducing the amount of positive control exerted by beneficial insects. Removing the predators with non-selective pesticides frequently resulted in a secondary pest population or a recurrence of the initial pest far greater in magnitude than the original infestation. Rachel Carson, with her 1962 book *Silent Spring*, made a dramatic statement concerning the effects of pesticide residues. DDT and related chlorinated hydrocarbon compounds were a highly successful group of chemicals because they persisted in

John Brett, formerly Community Gardens Coordinator at Denver Botanic Gardens, is continuing to work with the IPM program at the Gardens while attending graduate school at the University of Colorado.

the environment and continued to control the pest insect over a long period of time. Not only did they affect the functioning of insects, but DDT and the products of its decay were very persistent in the environment at large and began adversely to affect higher life forms, particularly birds.

Eventually many of these chemicals were removed from the market (except for special cases) and their deleterious effects are slowly reversing. But there are many pesticides currently in use on a widespread basis whose long term environmental effects are unknown. Many chemical pesticides are no longer effective or are so expensive to use on a broad scale that they are no longer economically feasible. Some insects on certain crops (e.g., boll weevil, spider mites) have become resistant to nearly all available chemical controls.

An alternative to the heavy use and dependence on chemical pesticides is integrated pest management (IPM): the concept of using a series of strategies to maintain pest species at an economically tolerable level, while minimizing adverse environmental effects. Most of the research to date targets agricultural interests, chiefly because of the huge monetary value of agriculture in this country. Some of this research information and related techniques are filtering down to the general public and are being adapted to urban horticultural needs. Additionally, research geared toward the needs of gardeners is being done by botanic gardens, urban agricultural extension services, individual gardeners, and others.

The IPM concept is based on a number of factors. A fundamental tenet is that chemical pesticides are not necessarily the first or best line of

defense. An understanding of the life cycle of the insect or disease and the pest-plant interaction is fundamental to successful application of the concept and allows for exploration of various strategies that will achieve the necessary control. Cost effectiveness and safety are utmost concerns, especially for commercial growers.

Monitoring pests

Monitoring pest species is one of the most important considerations when working with an IPM framework. Among the many insects and other organisms in the garden, the vast majority are beneficial or innocuous. Insects (and diseases) must be identified as a pest species before any other action is taken. In many cases pest species will be present in quantities that are not deleterious to the specific plant; therefore control measures may not be appropriate or necessary. It is also necessary to monitor the pest in question carefully to determine when it has reached a density, or caused unacceptable levels of damage to the plants, to warrant control measures. This is a crucial point: to know when an insect or disease needs attention, but before it has reached a level that makes it difficult or impossible to control. This is known as the economic threshold when dealing with commercial or agricultural crops. An aesthetic threshold needs to be considered when working with ornamental plants. The point at which the damage becomes visually unacceptable may be below the level that would be detrimental to the plant. Even so, this level may be above that at which many people will spray. A new awareness of plant-pest interaction and what constitutes unacceptable damage is needed.

For the urban horticulturist or small-scale gardener the most

common methods of monitoring are visual. Monitoring the garden environment involves knowing something about what pests are likely to occur on what plants and when. Knowledge about the life cycle of a given pest species is also important. Many insects are easily controlled in the egg or larval stage, but can be very difficult as adults, so identification at different stages of their development is vital. This is not easy.

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Fundamental to visual monitoring is an awareness of the garden environment and taking the time to look for changes or problems. Knowing a plant's appearance when healthy and growing well will make it relatively easy to recognize the off-color leaf, the droopy branch or the distorted stem before it has become seriously damaged.

Traps can be used to monitor those insect species that are known to occur seasonally that are quite destructive, and for which chemical control must be timed correctly to achieve control. (Ash-lilac borers and codling moth are good examples.) These traps are usually open-ended cardboard structures with a sticky substance on the inside impregnated with a chemical attractant (pheromones) that lures only the desired insect. When the insects hatch or arrive they are attracted to the traps, which indicate their presence to the gardener. When the number of insects trapped during a specified period reaches a predetermined number, control measures should begin. In this way control is timed for the greatest impact on the pest, thus limiting the number of times control measures (e.g. spraying) need to be taken. Traps, relatively unavailable to the home gardener, are expensive; and many of those developed have been for agricultural crops, not ornamentals.

Biological control

A variety of pest control methods are available to the gardener. Biological control is the use of one biological organism to control another. These often are very species specific; they attack only one particular insect or group of insects. The best known are the predator insects — lady bugs and lace wings are common examples. These effect control by eating the pest insect, frequently in large numbers.



The use of microbial organisms to control pest problems has been in use for many years and is receiving more attention. The bacteria, *Bacillus thuringiensis* (BT), is becoming increasingly popular. It is effective against a broad range of caterpillars (butterfly and moth larva). Important pests controlled by this organism are the cabbage looper and imported cabbage worm (both damage members of the cabbage family), and the tussock and gypsy moths which defoliate trees. When consumed by a caterpillar feeding on the sprayed host plant, the bacteria produces a toxin which paralyzes the insect's digestive tract within two to three hours, causing it to stop feeding. Because BT is specific to caterpillars (but not adult moths or

butterflies) and is applied directly to the affected crop, virtually no other life form is harmed. A related bacteria, *Bacillus popilliae*, the milky spore disease that successfully controls Japanese beetles, has been used widely for many years.

Parasitoids

A parasitoid (an insect, particularly a wasp, parasitic on another insect, living either inside or outside the host), *Pediobius foveolatus*, is popular for controlling Mexican bean beetles. The wasp lays its eggs inside the bean beetle larva; the wasp larvae feed from the inside of the bean beetle larva eventually killing it. Because the wasp has a shorter life cycle than the bean beetle, one introduction early in the season will often provide control for the entire season. Timing is crucial in the release of this wasp: too early and there will be an insufficient population of beetles to sustain the wasp, too late and the beetle will begin pupating and can withstand the attempts of the wasp to lay eggs. While this control method has been used with success in agriculture, it is only now being tested for effectiveness in the home garden.

Another type of biological control is breeding resistance to disease, and in some cases insects, into plants

enabling them to withstand predation. The resistant plant may be physically (i.e. hairy leaves) or physiologically (bad taste, poisonous) immune to attack, or tolerant of attack (able to produce in spite of damage).

Preventative methods

Cultural methods of pest control, though largely preventative, are no less important and can be very effective. Keep desirable plants healthy; keep the garden clean and weed free thus eliminating many reservoirs for insects and diseases; cultivate carefully to protect plant roots thus preventing the introduction of soil borne diseases; avoid watering the leaves of plants susceptible to certain diseases. These are all simple methods that promote or benefit a healthy garden. Good cultural practices will often control pest problems. Regular spraying with cold water is often sufficient to control spider mites on infested plants. Some gall forming insects are controlled by simply pruning out the galls and destroying them. Immediate removal and destruction of a virus-diseased plant and disinfecting the tools used will prevent transmission of the disease to other plants.

Mechanical controls

Mechanical control measures involve physically manipulating the pest to prevent it from feeding. Hand picking large insects, while less than pleasant, is very effective. Traps, whether sophisticated pheromone traps or saucers of beer at soil level to capture slugs, are helpful in a total control program. Physical barriers, such as cutworm collars around newly planted seedlings, prevent the insect access to the plants. A forceful jet of water can be used to dislodge insects from leaves.





Chemical options

Chemical options available to home gardeners are far fewer than for commercial growers. They are generally less toxic and easier to use than many of the agricultural chemicals. Even so, a vast array of chemical sprays, dusts, and granules can treat just about every garden ailment. Chemicals kill, repel, attract or sterilize. Chemicals to kill (pesticides) are the best known. Common examples for the garden are Malathion, Diazanone, and Sevin.

Soap has been known to have insecticidal properties for many years, but fell into disuse with the advent of cheaper, easier, more toxic chemicals. Soaps are an excellent control against certain pests. Insects, particularly those with soft bodies (aphids, white flies, and mealy bugs), are protected from the drying effects of the environment by their cuticle, a waxy external coating. Soaps dissolve the cuticle causing the insect to dehydrate and die. Research has been done to identify soap compounds effective at killing insects but that are relatively non-toxic to people and plants and which break down rapidly. Some of these are now available commercially.

Chemicals to repel, attract or sterilize are only beginning to be researched on a commercial scale and are seldom available to home gardeners. Chemicals to repel have been discussed at length in the popular literature on organic gardening. Garlic and hot pepper sprays are most commonly mentioned. In certain instances these home-made repellent sprays can be quite effective. There is some indication, for instance, that flea beetles are repelled by regular doses of garlic spray on host plants.

Chemicals for attracting insects are most often pheromones used in monitoring traps for some insects but not widely used outside of agriculture. Possibilities also exist for wholesale trapping of insects rather than for monitoring only. The use of sterilants to render males incapable of fertilizing females and thereby reducing offspring is a fine technique for large scale operations and major pest outbreaks but not practical for small gardens.

With attention to the condition of the garden, research on alternative methods, and a willingness to try non-chemical methods of pest control, one can create a healthy garden environment that does not require the heavy doses of toxic chemicals that have become traditional in landscape maintenance. There is no denying that it may take more time and effort than the chemical approach but it will, in the long run, probably be more successful and certainly more satisfying.

A second article in a future issue of *The Green Thumb* will outline in more detail specific strategies for controlling some of the more common insect and disease pests in area gardens.

Aphid Infestation on Honeysuckle

William A. Weber

The unprecedented wet summer that we have experienced along the Front Range during 1983 has evidently stimulated a very unusual outbreak of aphid infestation on the cultivated honeysuckle, *Lonicera morrowii* A. Gray and *L. tatarica* L. The organism is *Hyadaphis tataricae*. According to a recent article in *American Horticulturist News Edition* (Sept. 1983), this aphid appeared in Canada about eight years ago and four years later showed up in Chicago.

Wherever I have examined these honeysuckles in the city of Boulder, the plants are affected in an identical way, and massively. As far as I am able to determine, the way in which the attacks manifest themselves has never been described.

Aphid activity appears to be restricted to certain parts of the plant. The short shoots which produced flowers and are carrying red fruits of this season are not affected. Evidently these shoots do not continue growth beyond this season. The shoots carrying the buds for the flowering branches of next season are very long, stout erect stems or "canes." The terminal buds of these shoots are the ones chosen by the aphids. Somehow the dormant buds for next season are stimulated to grow wildly in midsummer. The apices of these shoots display a proliferation of slender, weak and pendent branchlets with small leaves. These leaves have been cemented together with sticky

material by folding lengthwise, and upon dissection, large numbers of wingless aphids are seen to be enclosed within the fold. By the end of August the leaves have withered, the branches hang in an unsightly mass from the tops of the tall sterile branches, and all but a very few of the aphids have departed, leaving bits of casts and solidified cement. Presumably there will be no blossoming from these shoots next year because of the infestation.

A few nymphs of a species of reduviid bug have been observed "cruising" the branches, presumably preying on the aphids. Little seems to be known about the juveniles of these bugs and how they spend their early stages.

The natural history of aphids should be a profitable study for amateur botanists, since it seems that the study of aphids has been done by entomologists without much concern for the biological responses of the plants to aphid attack. I have not found anything in the literature concerning the stimulation of abnormal growth on the part of the aphid or of its preference for certain types of branches.

Colorado once had two noted specialists on Aphidology, C. P. Gillette and M. A. Palmer, who published a definitive study of the aphids of Colorado in three parts (*Annals Entom. Soc. Amer.* 24:827-934. 1931; 25:369-496. 1932; 27:2133-255. 1934). Palmer later published a comprehensive book on the aphids of North America, but the science of aphidology now seems to be lacking in students. Here is an opportunity for local work.



Do Scientific Plant Names Confuse You?

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Beverly Nilsen

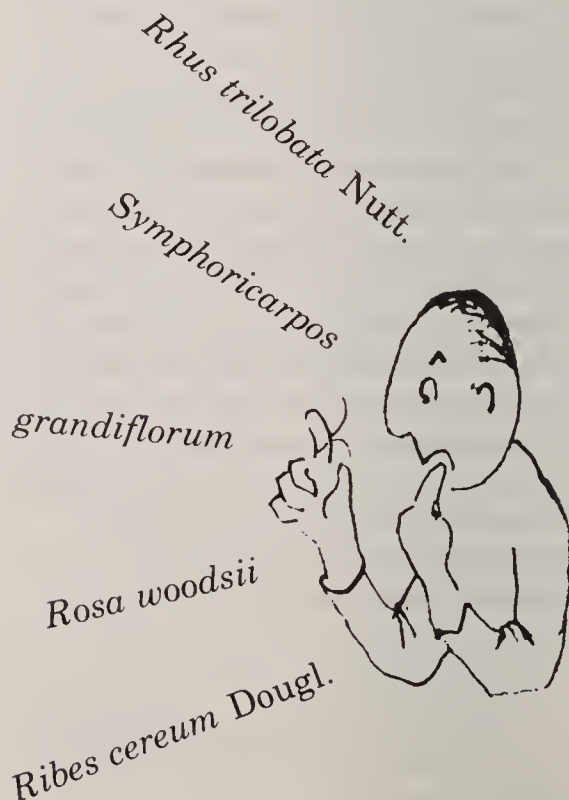
With the vast number of plants known to man there was an absolute necessity for a system of naming. Prior to the eighteenth century the names of plants were polynomial. Those names were composed of several words and were generally wordy descriptions of the plant itself. Records show that Gaspard Bauhin (1560-1624) made the first attempt at using a binomial system of nomenclature. He gave both a generic (genus) and specific (species) name to many of the plants he described. Joseph de Tournefort (1656-1708) took this system a bit further. He became known as the father of the modern genus concept. He treated the genus as the smallest unit of classification with the species listed as variants of the genus. During the same time Pierre Magnol (1638-1715) contributed the idea of plant families. The first extensive and consistent use of the binomial system was credited to Carolus Linnaeus (1707-1778).

The first detailed set of rules on plant

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nomenclature was set forth by Augustin de Candolle (1778-1841). His son, Alphonse, recognized the need for standardization in naming plants and brought together a group of botanists at the First International Botanical Congress in 1867. This meeting produced the first Code of Nomenclature. This Code eventually evolved into the International Code of Botanical Nomenclature which determines regulations regarding the naming of plants.

Scientific names consist of Latin or



Latinized words. Botanical Latin, a study in itself, is the language that botanists all over the world use in naming and describing plants. The naming of a plant is left to the discretion of the author in keeping with the above mentioned Code. The author, or authority, is the person (or persons) who publishes the description and name of the plant. In printed matter, the name that follows the scientific name indicates the author's name as *Iris japonica* Thunb. This plant was first described by the Swedish botanist Carl Thunberg. In this article, however, author's names will not be listed as the emphasis is on the meaning of the species names.

cultivar or form which give further information about the plant.

Common names are usually simple and easy to remember but they do not necessarily tell you anything about the plant. Pineapple is not a pine nor is it an apple. The calla lily is not a lily. Some common names may refer to more than one plant; some may be known only in a certain geographical region. The stories behind vernacular names are often interesting but no orderly system is involved.

The plants at Denver Botanic Gardens are identified with black phenolic labels. The labels indicate the scientific name, the common

Scientific words are not selected at random but have a meaning. Botanical Latin is complex and to interpret all of these words would take time and study. Briefly, a genus name may be a descriptive term as *Physocarpus* meaning bladder-fruit; an old Latin or Greek name as *Quercus* or *Acer*; or the name of a person as *Magnolia* named for Pierre Magnol. Species names will give information about that specific plant whether it be a characteristic of the plant itself, information about its habitat or, again, a name of a person. Additional names may follow the species name as subspecies, variety,



name, if any, and the family name. In addition, the plant labels in the Rock Alpine Garden show the natural habitat of the plant.

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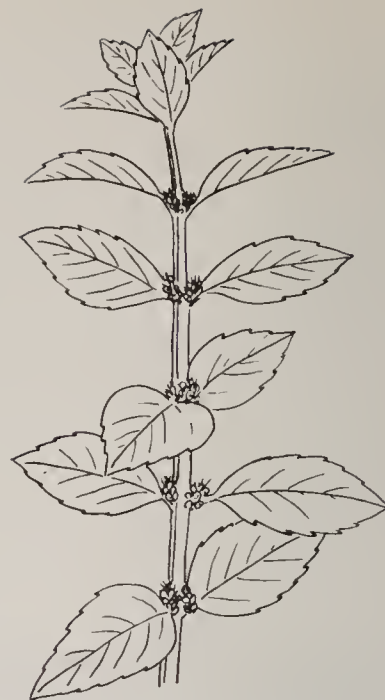
A plant family is a group of closely related genera. Plants are grouped together because of certain similarities. Each family has its own characteristics which make it different from any other family. In the Herb Garden there are several genera of the mint family, Labiatae. Noticeable characteristics of this family are square stems, opposite leaves and aromatic foliage. There you will find: *Agastache* (giant hyssop), *Ballota* (black horehound), *Cedronella* (canary balm), *Hyssopus* (hyssop), *Lavandula* (lavender), *Melissa* (balm), *Mentha* (mint), *Monarda* (horsemint), *Nepeta* (catnip belongs to this group), *Marrubium* (horehound), *Ocimum* (basil), *Origanum* (marjoram), *Rosmarinus* (rosemary), *Salvia* (sage), *Teucrium* (germander) and *Thymus* (thyme).

The number of genera in a plant family can vary a great deal. The sunflower family, Compositae, is one of the largest with nearly a thousand genera. The inflorescence is made up of a cluster of distinct flowers. Members of this family are easily recognized. Everyone is familiar



Sunflower

Dandelion



A mint—*Mentha arvensis*

with the sunflower, *Helianthus* or the dandelion, *Taraxacum officinale*. Throughout the Gardens are other easily recognized genera: *Aster*, *Chrysanthemum*, *Cosmos*, *Dahlia* and *Zinnia*. Acquaint yourself with less familiar ones as *Achillea*, *Ageratum*, *Antennaria*, *Artemisia*, *Catananche*, *Centaurea*, *Coreopsis*, *Erigeron*, *Gallardia*, *Helichrysum*, *Liatris*, *Matricaria*, *Rudbeckia*, *Santolina*, *Solidago* and *Townsendia*.

On each visit to the Gardens select a different family and see how many members you can locate. See if you can distinguish their similarities. Another group probably familiar to all is the rose family, Rosaceae. Many genera of this family are scattered throughout the Gardens: *Amelanchier*, *Cercocarpus*, *Chaenomeles* (flowering quince), *Cotoneaster*, *Crataegus* (hawthorn), *Duchesnea*, *Fallugia*, *Fragaria* (strawberry), *Geum*, *Malus* (apple and crabapple), *Potentilla*, *Prunus* (plum), *Pyracantha*, *Pyrus* (pear), *Rosa* (rose), *Spiraea* and *Waldsteinia*.

A genus is a group of closely related

species. All of the true oaks belong to the genus *Quercus*, as all of the true maples belong to the genus *Acer*. The species name indicates a specific kind of plant as the black oak (*Quercus velutina*), the pin oak (*Quercus palustris*) or the silver maple (*Acer saccharinum*).

Many species names translate into some information about the plant itself. Some relate to familiar words so by looking at the species name one can glean certain information about the plant. The nativity of a plant is where the plant grows naturally, and often the species name tells the area where the plant is native as *chinensis* (of China), *japonica* (of Japan), or *mexicana* (of Mexico). Keep in mind, though, that this name usually represents a general region and does not necessarily mean that it grows exclusively in that one place. In the Rock Alpine Garden alone you will see plants from many countries.

Abies koreana (of Korea).

Acaena nova-zealandica var. *pallida* (of New Zealand).

Acer japonicum, *Chelidonium japonicum*, *Mahonia japonica*, *Rhododendron japonicum* (of Japan).

Asarum europaeum, *Trollius europaeus* (of Europe).

Astilbe chinensis (of China).

Cowania mexicana (of Mexico).

Draba tibetica (of Tibet).

Euphorbia graeca (of Greece).

Genista hispanica (of Spain).

Hypericum aegypticum (of Egypt).

Ledum groenlandicum (of Greenland).

Orchis italica (of Italy).

Potentilla nepalensis (of Nepal).

Senecio chilensis (of Chile).

Throughout the Gardens you will encounter other geographical indications used as species names such as: *amurensis* (Amur River region, northeastern Asia), *arabicum* (of Arabia), *asiatica* (of Asia),

canadensis (of Canada), *canariensis* (of the Canary Islands), *corsicus* (of Corsica), *germanicus* (of Germany), *patagonicus* (of Patagonia), *sachalinensis* (of Saklin Island, northern Japan), *sibirica* (of Siberia), *syriacus* (of Syria) or *yunnanensis* (of Province of Yun-nan, China).

A species name can even reveal from which mountain range a plant comes. Again, in the Rock Alpine Garden you will find:

Alyssum altaicum (of the Altai Mountains).

Arabis caucasica, *Scabiosa caucasica* (of the Caucasus).

Campanula carpatica (of the Carpathians).

Eremurus himalaicus (of the Himalayas).

Fritillaria pyrenaica, *Petrocoptis pyrenaica* (of the Pyrenees).

Natural regions of the world may be indicated as *arctica* (arctic region) or *deserti* (desert region). Many plants grow in the alpine plant zone throughout the world and as you would expect many are in the Rock Alpine Garden — among them *Dodecatheon alpinum*, *Eryngium alpinum*, *Phlomis alpina* and *Scutellaria alpina*. In the Japanese Garden you will find *Ribes alpinum*, in the Peony Garden there is *Rhamnus alpina* and in the House Garden, *Laburnum alpinum*.

A species can be named in honor of a person. A few that you may see in the Gardens are:

Abies fraseria — named for John Fraser, Scottish botanist, plant collector.

Berberis thunbergii — named for Carl Thunberg, Swedish botanist, taxonomist, plant explorer, physician.

Celtis tournefortii — named for Joseph de Tournefort, French botanist, plant collector, plant explorer.

Cotoneaster dielsiana — named for
Fredrich Ludwig Emil Diels,
German botanist.

Lilium henryi — named for
Augustine Henry, Irish
physician, dendrologist, plant
explorer, taxonomist.

Spiraea menziesii — named for
Archibald Menzies, Scottish
plant collector, plant explorer.

Oftentimes, the species name
describes something about the
growth habit or some particular
characteristic of the plant. These
names can easily be translated to
words that are familiar; for instance
in *Populus tremuloides*, the word
trembling or quivering comes to
mind. It is the quaking aspen — the
leaves tremble in the breeze. Other
specific names often used include:

annuus — annual. One year —
completes life cycle in one year.

ascendens — ascending.

compactus — compact. Look for
dense growth.

elegans, magnifica, superbus —
elegant, magnificent, superb.
Some part of the plant is
impressive, an opinion which
may or may not be shared by the
viewer.

flora — floral, flower.

flore-pleno — roughly translates
to plenty of flowers. Means
double.

grandiflora — grand, large.
Large flowers.

liliflorus — lily flower. Not a lily
but the shape of the flower is
similar to the lily flower.

multiflora — many flowers.

Petunias are listed as
multiflora or *grandiflora*.

folia, foliate — foliage, leaves.

Sometimes even the number of
leaves may be indicated as
Akebia trifoliata (3 leaves) or
Parthenocissus quinquefolia (5
leaves).

alternifolius — alternate leaves.

oppositifolius — opposite leaves.



Allium giganteum

fragilis — fragile, brittle.

giganteum — gigantic, huge.

Allium giganteum — huge
flower head.

horridus — horrid, horrible.

Probably thorny or prickly.

horizontalis — horizontal.

Growing close to the ground.

marginatus — margin. Basic leaf
color edged with another color.

nauseosus — nauseous. Evidently
not recommended for eating.

pallidus — pallid, pale.

pendula — pendulant, drooping.

Betula pendula, weeping birch.

plumosus — plume like. *Celosia
plumosa* has feathery-type
blooms.

prostratus — prostrate, flat. Plant
growth along the ground, not
upright.

pygmaeus — pygmy, small.

spinosus — spiny.

variegatus — variegated. A name
that occurs often. Foliage of
different colors in streaks or
spots.

zebrinus — zebra, stripes.

However, don't expect black and
white.

This article gives only a very brief
glimpse into plant names, but
perhaps on future visits to the
Gardens you will find plant names
a little less confusing.

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Summer 1984

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Number Two



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Trough Garden

Frances Frakes Hansen

The Green Thumb

Summer 1984

Vol. Forty-one, Number Two

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Editor

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Denver Botanic Gardens, Inc., maintains a collection of living plants, both native and exotic, for the purpose of acquiring, advancing and spreading botanical and horticultural knowledge.

This is a non-profit organization supported by municipal and private funds.

Trough Gardening

by Stan Metsker

Whether you have a small patio or a large garden, you can enjoy gardening in homemade hypertufa troughs or planters. Miniature gardens created in these shallow containers are movable and can be used in groups as the focal point in a small area or as fillers for out-of-the-way corners in a larger landscape. Plant material can vary according to the gardener's interests and skills.

Originally, in England, troughs were cut from limestone or sandstone and used for watering animals. Gardeners also found them excellent for growing miniature gardens. Many plants do well in troughs, and hard-to-grow plants are often easier to establish and maintain in a trough than in the ground.

A trough made of hypertufa is an attractive substitute for an old stone farmyard trough and is fairly easy to make. Ingredients are two parts Portland cement, three parts crumbled sphagnum peat moss, and three parts perlite, plus a wire reinforcing armature. (Some variants of ingredients are listed in the references.) Colored powders formulated for mixing with concrete may be used to vary the color, and they invite experimenting with varying colors on different parts of the trough to simulate differences in coloration of natural rock. Ingredients should be blended together

dry, and water added gradually until the mixture is the consistency of cottage cheese. About five gallons of dry mix will make a small trough (Fig. 1).

Any type of form may be used, from wooden frames or cardboard boxes to a more free-form style in which the trough is built upside down over wet sand. For troughs other than those made over wet sand, both inner and outer forms are essential for the inside and outside walls. Lightweight plastic sheeting may be used to separate the form from the hypertufa mixture to assure an easy release when the trough is finished. Wooden frames may be covered with motor oil instead (Fig. 2).

Before adding water to the dry hypertufa mixture, make a form of chicken wire sized so that the bottom will extend horizontally to the center of the side walls. The top of the side walls of the wire reinforcer should be about $\frac{1}{2}$ inch below the lip of the finished trough. If the trough is to be rectilinear, be sure to wire together the corners of the reinforcing form (Fig. 3).

If a wooden form is used, place it on an oiled piece of plywood; if cardboard boxes, make sure the inside is covered with lightweight plastic sheeting. Put enough hypertufa mix in the bottom of the outer, larger form for one half the bottom thickness — about $\frac{3}{4}$ inch (Fig. 4). The free-form trough made over wet sand should be covered to half the desired thickness of the sides. At this point, place the wire armature in position and add more mix to complete the bottom of the

Stan Metsker, vice-president of the Rocky Mountain Chapter of the American Rock Garden Society, occasionally teaches classes on trough gardening.



Fig. 1. Ingredients for trough.



Fig. 4. Forming bottom of troughs.



Fig. 2. Wooden or cardboard box frames.



Fig. 5. Reinforcer and more hypertufa added.

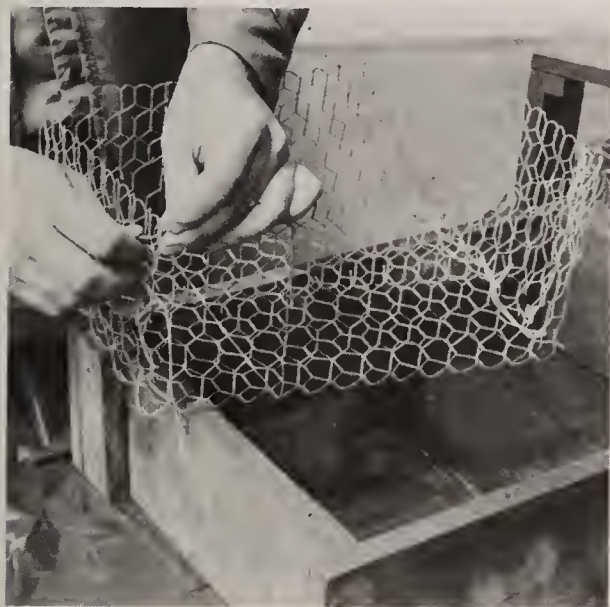


Fig. 3. Wire reinforcing armature.



Fig. 6. Drainage holes in bottom.

trough (Fig. 5). Pat this down carefully, making sure there are no air spaces inside and insert small oiled dowels through the bottom to form the drainage holes — or make them by punching through the soft hypertufa with your finger (Fig. 6). Instead, these may be drilled later.

To form the side walls of the trough, place the inner form in position (Fig. 7), and carefully pack the hypertufa mixture tightly between the inner and outer forms with the wire reinforcer centered between. Again make sure there are no air holes (Fig. 8). Concrete dye may be added to the wet hypertufa mix for the side walls to simulate natural sandstone. After the trough is formed, let it dry slowly in a shaded location until the walls have set. The time required, a day or more, depends upon temperature and humidity.

After the walls have set-up, carefully remove the forms (Fig. 9). At this stage the trough is still very "green" and could break, though it can be patched easily. When the trough has hardened sufficiently, use a wire brush and a rasp to texture the sides, round off the corners and get rid of the smooth concrete look (Fig. 10).

Remove the dowels from the drainage holes or drill them, and allow the trough to dry very slowly — one or two weeks or longer. During the drying process, keep it in the shade covered with plastic or damp burlap. If cured slowly, the trough will be strong and resist cracking or chipping from frost.

Before planting, the trough can be given an acid bath to counteract any alkaline reaction of the cement. This may be done by pouring vinegar over it. Others recommend plugging the drainage holes and filling the container with a potassium permanganate solution — a teaspoon or two added to sufficient water to fill the trough. Leave this in for at least a half day and also paint the exterior with the same solution.

Select a soil mix — alkaline to acid — according to the plants you wish to grow, with those requiring similar conditions



Fig. 7. Putting inner forms in place.



Fig. 8. Forming the side walls.

grouped together in one trough. A good all-purpose mix would be one-half sandy soil and one-half peat moss. Watering can be limited for succulents or increased for water-lovers. In fact, if you wish to ensure adequate moisture, you may wick water from a pail underneath by installing some nylon rope from the water source into the soil mix; or you can use drip irrigation. In the garden setting, if lawn sprinklers reach the troughs, adequate water probably will be provided.

A wide variety of plants can be grown in troughs, but generally, small plants that have reasonable longevity and are not too aggressive are desirable. Excessive growth can be controlled to some extent by using little or no fertilizer. On occasion garden rudbeckias have self-seeded into my troughs, but they get only about 5 inches high as compared with the 15-18 inches in the garden. Alpine plants are



Fig. 9. Removing forms carefully.



Fig. 10. Rounding off edges.

especially at home here because they are naturally dwarf and often thrive in meager soils (Fig. 11).

The proportion and composition of miniature gardens are very important. Unless a formal arrangement is your plan, do not place rocks or large plants in the exact center. If a plant gets too tall or wide, trim it or replace it. Plants that trail over the edge soften the lines of the trough and are delightful. There is no limit to the variety of shape and size that troughs may take, nor to the variety of plantings — even including miniature shrubs and conifers.

Troughs, apart from their intrinsic charm, have the advantage of greater visibility for small plants. They bring miniature landscapes closer to their viewers to appreciate the beauty of the plants, explore their textures and enjoy their subtle fragrances.

Suggested plants for troughs

Full sun:

<i>Antennaria</i> spp.	Pussytoes
<i>Arabis carduchorum</i> Boiss.	Rock cress
<i>Arenaria hookeri</i> Nutt. ex T. & G.	Hooker's sandwort
Cacti (small native species)	
<i>Cerastium alpinum</i> L. <i>lanatum</i> Ascher & Graeb.	Woolly mouse-ear
<i>Dianthus x arvensis</i> Rouy & Foucaud	Pink
<i>Dianthus graniticus</i> Jordan	Maiden pink
<i>Draba bruniaefolia</i> Steven	Draba
<i>Erigeron compositus</i> Pursh	Cut-leaf daisy
<i>Eriogonum ovalifolium</i> Nutt.	Oval-leaf buckwheat
<i>Erysimum kotschyanum</i> J. Gay	Miniature wallflower
<i>Gypsophila tenuifolia</i> Biebl.	Alpine baby's breath
<i>Helianthemum canum</i> Boiss. <i>scardicum</i>	Sunrose
<i>Leontopodium alpinum</i> Cass.	Edelweiss



Fig. 11. Woolly mouse-ear blooming between rocks in hypertufa trough.

Lewisia rediviva Pursh Bitterroot
Papaver alpinum L. Alpine poppy
Penstemon caespitosus Nutt. ex A. Gray
 Mat penstemon
Penstemon teucrioides Greene Gray-leaf
 mat penstemon
Phlox bryoides Nutt. Mat phlox
Phlox muscoides Nutt. Moss phlox
Sedum acre L. 'Minus' Gold moss
Sedum dasyphyllum L. Hairy sedum
Sempervivum arachnoideum L. Spiderweb
 houseleek
Thymus serpyllum 'Minus' Dwarf lemon
 thyme
Veronica allioni Vill. Mat speedwell
Veronica repens Loisel. Creeping
 speedwell

Average sun/shade:

Acantholimon armenum Boiss. & Huet.
 Spikethrift
Aethionema oppositifolium Boiss. Stone
 cress
Aquilegia saximontana Rydb. Alpine
 columbine
Arenaria tetraquetra L. var.
granatensis Sandwort
Asperula nitida Sibth. & Sm. var.
puberula Woodruff
Astragalus spatulatus Sheld. Dwarf
 milkvetch
Campanula portenschlagiana Roem. &
 Schult. Bluebell
Dianthus freynii Vandas Pink
Dianthus subcaulis Vill. Pink
Draba aizoides L. Draba
Edraianthus pumilio (Portenschl.) A. DC.
 Grass-leaf bluebell
Helianthemum oelandicum Whalenb. var.
serpyllifolium Sunrose
Heuchera hallii A. Gray Hall's alumroot
Iberis saxatilis L. Dwarf candytuft
Iris pumila L. Dwarf bearded iris
Lewisia cotyledon (S. Wats.) Rob. *Lewisia*
Oxytropis multiceps Nutt. Tufted loco
Penstemon menziesii Hook. Cascade mat
 penstemon
Penstemon rupicola Howell Rock mat
 penstemon
Potentilla verna L. 'Nana' Dwarf creeping
 cinquefoil
Saxifraga paniculata Mill. Silver
 saxifrage
Sedum spp. Stonecrop
Sempervivum spp. Houseleek
Veronica bombycina Boiss. &
 Kotschy. Silky veronica
Viola pedatifida G. Don Birdfoot violet

Shade:

Aquilegia flabellata Sieb. & Zucc. 'Nana Alba'
 Dwarf fan columbine
Campanula cochlearifolia Lam. Fairy
 thimbles
Cystopteris fragilis (L.) Bernh. Brittle fern
Heuchera rubescens Torr. Coralbells
Hosta venusta F. Maekawa Dwarf hosta
Potentilla verna L. 'Nana' Dwarf creeping
 cinquefoil
Primula auricula L. Auricula
Telesonix jamesii (Torr.) Raf. Purple
 saxifrage
Woodsia oregana D. C. Eaton Oregon
 woodsia

Miniature shrubs and conifers:

Artemisia nova A. Nels. Dwarf sagebrush
Erinacea pungens Boiss. Purple broom
Juniperus communis L. 'Echiniformis'
 Dwarf juniper
Picea glauca Moench 'Echiniformis' Dwarf
 white spruce
Picea abies (L.) Karst. 'Little Gem' Dwarf
 Norway spruce
Picea abies (L.) Karst. 'Pygmaea' Dwarf
 Norway spruce
Picea mariana Mill. 'Nana' Dwarf black
 spruce
Pinus mugo Turra. 'Mops' Dwarf mountain
 pine
Pinus strobus L. 'Horsford' Dwarf white
 pine
Pinus strobus L. 'Pumila' Dwarf white
 pine
Potentilla fruticosa L. (Dwarf forms)
 Shrubby cinquefoil
Ptilotrichum spinosum (L.) Boiss. Spiny
 alyssum
Salix serpyllifolia Scop. Dwarf willow

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 Brooklyn, N.Y.: Brooklyn Botanic Gardens.
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 Ortho Books.

Sources of plants for troughs:

Daystar, R.F.D. 2, Litchfield, ME 04350.
 Siskiyow Rare Plant Nursery, 2825 Cummings
 Road, Medford, OR 97501.
 Denver Botanic Gardens Annual Plant Sale.
 Many local nurseries have rock plants and
 native plants that are suitable for troughs.

Educational Opportunities at DBG

by Merle M. Moore

*Man Must Be Sharpened on Man,
Like Knife on Stone
— Chinese Proverb*

Evolution and growth in our Gardens' educational programs have been readily apparent in recent years in the unique opportunities we have provided for students to expand their knowledge through internships, practicums and special projects. Denver Botanic Gardens, the leading display garden within the intermountain region of the western United States, offers students who are eager to learn a challenging and highly rewarding experience. Botanical and horticultural resources, dynamic and innovative educational programs, and a talented and skilled staff willing to share their knowledge with others, all combine to make our student training opportunities among the best in the country.

An example is our participation as a worksite for the Mi Carrera summer employment program, a career awareness endeavor of Denver's Mi Casa Resource Center for Women. In cooperation with their counseling staff, Larry Latta, in charge of our Horticulture Under Glass operations, has developed career training areas in the production greenhouses, in the conservatory and on the grounds where the students have made constructive contributions while exploring, not only horticultural career opportunities, but

their own personal goals and potentials.

One student pioneered the venture with us in 1981; the following summer two young women participated, and last summer there were four students. Each worked an average of 20 hours a week for a 10-week period. As planned, the program in 1984 will involve four Mi Carrera students at the Gardens working in the greenhouses, in the library, in the outdoor gardens, and in Community Gardens Square.

In 1982 Denver Botanic Gardens was recognized as the "Outstanding Non-profit Worksite" of the summer in the Mi Carrera program—a tribute to Mr. Latta and our staff for successfully integrating these students into our special environment where plants and people have an opportunity to grow.

As early as 1979 the Denver Foundation awarded the first of several grants to the Gardens allowing us to offer specialized internships in horticultural therapy. To date three students from Kansas State University have fulfilled their six-month departmental practicum requirement as interns here and have been awarded their degrees in horticultural therapy. One, Julia Beems, completed her internship in August 1982 and is now horticultural therapist at Craig Rehabilitation Hospital, Englewood. Another former student, Lynn Herschok Thompson, completed her internship in August 1981, then remained on staff to conduct a survey of potential need and found more than 60 Denver human service agencies and institutions

Merle M. Moore, executive director of Denver Botanic Gardens, is familiar with student intern programs both as an administrator and as a former student intern at Longwood Gardens in Pennsylvania.

interested in receiving horticultural therapy training and assistance from the Gardens. The survey will help the Gardens design programs in horticulture for the clients served by these agencies and institutions. In September 1983 Mrs. Thompson became a full-time professional staff member as coordinator of our Community Gardens program succeeding John Brett who returned to graduate studies.

With the recent completion of Morrison Horticultural Demonstration Center and the appointment of Judy Carrier to design and coordinate training operations in horticultural therapy, the need for an active intern program in this field is essential. It is our hope the Denver Foundation will continue its interest in underwriting internships at the Center. Current support for one six-month intern is \$4200. Additional funding is essential to ensure an adequate number of interns to maximize the great potential of this important outreach and public service role.

One of our trustees has generously funded, on an annual basis, a special professional internship to provide intensive training in the care and development of two of our largest and most valuable plant collections—the orchids and the bromeliads. Peggy Brown, former summer college intern here, presently holds this position and has been doing an exceptional job of maintaining these priceless living collections. Under the supervision and guidance of Larry Latta, orchid specialist, and Gary Davis, in charge of the bromeliad collection, Ms. Brown performs the day-to-day care of the orchids, maintains the plant displays on the upper level of Marnie's Pavilion, prepares surplus plants for the annual plant sale and will be developing our orchid virus detection and control program. Her experience and training here at Denver Botanic Gardens will be invaluable as she seeks future employment in either a public garden or a commercial horticulture position.

The largest single endeavor in

bringing students to the Gardens to learn by working alongside our professional staff and volunteers is our summer college internship in applied horticulture, a program under the guidance of Patricia Pachuta, director of education at the Gardens. From its humble beginning with only one student in 1976, the project in 1984 has grown to ten students; each receives a stipend of \$2000 for the ten-week period. Interns work a 40-hour week with additional classes, field trips, and other related activities as part of their schedule. Included in their work assignments are planting, pruning, weeding, and watering plants on the outside grounds; seeding, transplanting and propagation in the greenhouses; tropical and subtropical plant displays in the conservatory and lobby court areas; plus service in the library, education department, and herbarium.

"I was able to see my strong points and weak areas and put my finger on my greatest interests. I was also able to judge my education in horticulture against that of others in the field. The exposure to all the skilled people working in the Gardens was my greatest joy. Their interest, professionalism, enthusiasm and ideas taught me a lot. They answered my questions and gave me the confidence that I needed."

Nancie Hill
Summer College Intern 1983

To be eligible a student must have finished at least the sophomore year of college with a grade point average of 2.50 or higher on a scale of 4.00. The student must have successfully completed one fundamental course in a botanical or horticultural discipline (e.g., Basic Botany or Introductory Horticulture) plus at least two of the following courses: Principles of Soils, Woody or Herbaceous Plant Identification, Greenhouse Management, Floriculture, Turfgrass Science, Plant Physiology, or Chemistry. Courses in progress at the time of application can be considered. Those who wish to receive college credit for the



Typical of a group of summer student employees is this photo of the 1982 student staff. In the front row, from left to right, are: Rhoda Burrows, Montana State University; Peggy Brown, Metropolitan State University and currently our Orchid Bromeliad Collections Management Trainee; Marie Bernal, Mi Carrera Program; James McLean, Colorado State University; and Doris Romero, Mi Carrera Program. In the back row, left to right, are: Judy Imbergamo, Orchid Bromeliad Collections Management Trainee from Metropolitan State University; Alison Winslow, University of Denver; Kevin O'Shea, Regis College; Page Owen, Oberlin College; Mary Conway, University of Northern Colorado; Sherri Rojec, University of Colorado. Also on the 1982 summer student staff but missing from this photo were Tom Manfred, Colorado State University who worked at Chatfield Arboretum; and Julia Beems, Kansas State University and Horticulture Therapy Intern.

internship may do so at the discretion of their college or university with the individual student responsible for making these arrangements.

In selecting students for the Gardens' summer college internship in applied horticulture we have traditionally given preference to residents of (or students attending colleges or universities in) the states of Colorado, Montana, New

Mexico, Utah, and Wyoming. During the past two years, with ten internships available, we have accepted several students from outside the Rocky Mountain region as well. This gives greater diversity to the program and opportunity for participants and staff to exchange ideas about gardening techniques and plant materials used in other parts of the country. In 1983 a

Venezuelan student enrolled at the University of Northern Colorado was one of our interns. As with all our students, he had much to share as well as much to learn.

"The flexibility of this program is probably the strongest point. I appreciated the way our ideas and suggestions were incorporated into the schedule. This showed me that we were there to gain an education and take advantage of what the Gardens has to offer."

Sherri Rojec
Summer College Intern 1982

In late November announcements about our college intern program are sent to colleges and universities throughout the region. Completed applications must be received at the Gardens by early March. Applicants are informed of their selection at the end of the month, and must then inform the Gardens of their acceptance of the internship by mid-April. A list of alternates is on file should any of those selected decline the internship.

Forty-three applications were screened for the ten internships awarded for 1984. As the program expands and more students have an opportunity to participate, "growing pains" are inevitable. Finding sponsors (individuals, foundations, garden clubs and other horticultural organizations, corporations) to help underwrite the intern stipends is an annual challenge. In recent years partial funding has come from the DBG Guild, the Associates of DBG, Around the Seasons Club, the Garden Club of Denver, and the children of Barbara Whelan in her memory. Our dream is that someday an endowment will be established to ensure that funds will always be available for this vital and rewarding program.

Finding adequate housing is another challenge that has evolved. These students earn a minimal wage and will be in Denver for only ten to twelve weeks. Temporary, short-term housing here is both scarce and expensive. The ideal

solution would be to find Botanic Gardens' members willing to offer a spare room or two. Another solution might be someone who needs a "house-sitter" while away for an extended summer trip. Perhaps some of you have other suggestions you would like to share? A lack of affordable housing could prevent a highly qualified student capable of making a significant contribution to our program from accepting an internship.

Having been a summer intern at Longwood Gardens in Kennet Square, Pennsylvania, between my sophomore and junior years of college, I truly appreciate the value of such programs.

"The lectures given during the ten weeks were all very interesting. The ones that seem to stand out in my mind were the lectures on bonsai and drought tolerant plants which are two areas I have always wanted to know more about."

Mary Conway
Summer College Intern 1982

The practical experience gained by student interns, I believe, is equal to the value of the stimulating new ideas they bring to the staff from their classrooms around the country. The opportunities such a forum provides to share ideas and exchange information is exhilarating and refreshing.

The students enrolled in our diverse programs give a vitality to the Gardens that is not duplicated by any other means. If you should happen upon one of these students at work in the Gardens, take a moment to introduce yourself and join me in expressing our appreciation for the important contribution they are making to Denver Botanic Gardens. ♣

"Perennial" Annuals?

by Andrew Pierce

Plants seem to appear on some pre-destined course with their emergence associated more with the time of year, the latest frost date and the amount of winter freeze than with their method of regeneration. The average gardener does not always realize the number of annual plants that can be self-perpetuating in the garden. These plants appear without any soil correction, preparation or other effort by the gardener. The seeds survive the winter and grow where they fall — though not always in exactly the desired spot.

During the past few years it has been interesting to note certain plants that, without any help from their caretaker, come to life annually. This desirable trait has been used effectively in the Perennial Borders at the Gardens and, indeed, has saved on the cost of planting in both materials and labor. Annuals used in a perennial garden where spring bulbs have flowered extend the season of color and fill the empty spaces.

One of the most interesting self-sowing plants in our Perennial Border is *Nigella damascena* L. originally planted as a summer annual four years ago. Each year multitudes of fine-leaved seedlings appear which are topped by fresh blue rosette-like flowers later in summer. Color may vary from bright cornflower blue, as in the variety 'Miss Jekyll', to



Love-in-the-mist — *Nigella damascena*

occasional whites in 'Persian Jewels'. Love-in-the-mist, from the filament-like bracts surrounding the blooms, is its traditional name; but it is also called devil-in-the-bush, referring to the bristles on the seed capsule still encased in the lacy bracts. *Nigella*, a diminutive of *niger* comes from its black seeds which are enclosed in the curious, inch-long, paper-like, horned capsules. These extremely decorative pods make fascinating dried flower arrangements.

A plant that has self-sown itself across the world is *Cosmos bipinnatus* Cav. Originating in tropical America, it was introduced into England as early as 1535, such was the popularity of this easy, sun-loving, often quite drought resistant plant. Miles of the 4-foot high plant sway by the roadsides in South Africa. The pink, red and occasionally white flowers

Andrew Pierce, assistant director of Denver Botanic Gardens, is a gardener with an extensive knowledge of both cultivated and native plants.

are borne above the finely divided foliage, and in the Perennial Border cosmos have grown as tall as in nature. They do not spread far from the original location, so with their heavy reseeding it is necessary to thin the seedlings drastically. 'Sensation', 'Dazzler' and other cultivars may be sown to extend the range of color and period of bloom; but as with most hybrids, regeneration over the years produces reversion toward the original species. Reduced seed production may also occur.

Euphorbia marginata Pursh, a native of the mesas and plains in Colorado and throughout much of mid-United States, is a favorite under cultivation in many areas. As with its relative, the poinsettia, beauty is in its foliage rather than in the insignificant flowers. White-margined leaves appear on younger plants of snow-on-the-mountain and toward maturity some may be completely white. With its ample lateral spread, this species reseeds to fill empty spaces among perennials in the border. It requires a sunny location and adequate water to produce well.

The state flower of California, *Eschscholtzia californica* Cham., regenerates sporadically, often in dry, rocky areas between stones along pathways. As may be expected, the California poppy flourishes in sunshine but under severe drought conditions flowers may be few. If given water and care, this species produces a profusion of orange flowers in its many color variations and continues to bloom from



Bells-of-Ireland — *Molucella laevis*

spring through summer.

The new Cutting Garden at Denver Botanic Gardens has its own clientele of self-sowers. Tassel-flower, *Emilia javanica* (Burm.f) C. B. Robinson, a member of the daisy family comes back in profusion annually. In the same family, the showy blue *Catananche caerulea* L., may be perennial here; but each year young seedlings appear and flower in their first season. Much admired as dried flowers, these everlastings hold their color well. Commonly known as Cupid's-dart, they are indeed one of the surprises of regeneration in the perennial



Rocket Larkspur — *Delphinium ajacis*

gardens as they are considered on the borderline of hardiness in the first place.

Not from Ireland but originating in areas east of the Mediterranean, bells-of-Ireland, *Molucella laevis* L. has small white flowers inside the expanded apple-green calyxes. Developed seeds nestle like eggs in the base of the calyx and the whole spike is so clustered with these attractive 'bells' that it hardly has room for leaves. Germination is spasmodic and often away from the original location so transplanting may be required. This should be done when the seedlings have two true leaves.

Johnny-jump-up, a form of *Viola tricolor* L., seeds itself freely and, though classified as a short-lived perennial, regenerates annually as well. In certain situations Johnny-jump-ups may even be considered weeds but their individual flowers are often the first spot of color in spring and the last in autumn.

The coarse but colorful *Echium vulgare* L., commonly called blueweed or viper's bugloss, is noted more, perhaps, for its multitude of offspring than for its beauty. Given the opportunity it can become a weed in the Herb Garden. There also mignonette, *Reseda odorata* L. and the pot marigold, *Calendula officinalis* L. occasionally produce crops of volunteer seedlings.

Flowering from the middle of May until late autumn, sweet alyssum, *Lobularia maritima* (L.) Desv., can be used as a self-sowing ground cover under roses and gladioli or in other bare areas in the garden.

Where tall plants enhance the perennial border, the larkspurs have their place. *Delphinium grandiflorum* L. is a perennial but self-seeds and blooms in the same year. The annual rocket larkspur, *Delphinium ajacis* L., with its dense spikes of spurred flowers fills in empty spaces with its regenerating seedlings.

Everyone has plant favorites and among them self-perpetuating annuals may have a place. They can provide cover and color with a minimum of effort from their caretaker. ♀

FOCUS ON *Piper nigrum* IN THE BOETTCHER MEMORIAL CONSERVATORY

by Peg Hayward

Native to the hotter parts of India, *Piper nigrum* L. (Piperaceae) is the source of our common table pepper. Introduced into Java about the beginning of the Christian era, it is now cultivated in other tropical regions where rainfall is heavy.

Pepper is among the most ancient objects of trade between East and West. Theophrastus mentioned the use of pepper as a spice in the fourth century B.C. Before modern refrigeration, pepper and other condiments were more prized even than today. Pepper retarded the spoiling of food and made food already tainted and highly odorous more palatable. Pepper was so highly regarded that in medieval England rents and taxes were often exacted in dried pepper berries.

Piper nigrum, a perennial climbing vine, has a woody stem swollen at the joints and shiny dark green leaves. Minute flowers, arising at the nodes, are in catkin-like spikes 4 to 6 inches long. When pollinated these tiny flowers may mature into globular berries about the size of a pea with a thin pulp around a single seed. The berries are green at first, turning red as they ripen. Vines are not permitted to produce flowering spikes until they are more than 2 years old. It takes 5 to 6 months from the emergence of the flower spike and 4 months after

flowering to ripen the fruits; thus the first harvest is 2½ to 3 years after planting.

Curiously enough, both black and white pepper are derived from the same plant. Black pepper is the whole dried fruit. The berries are gathered just when they begin to change color. Spread on mats in the sun to dry, they blacken. When thoroughly dried they are ground and sifted. On the other hand for white pepper, as it is manufactured in the Orient, the berries are gathered when ripe and left to soak in water for about a week to rot the mesocarp. Spikes are then trampled by barefoot laborers to loosen the stalks and skins. Following this, the peppercorns are washed, dried and ground. This unappetizing procedure is not followed on modern plantations located in the New World where the pepper is freed of its outer covering by machinery.

White pepper is less pungent than black. The pungency is caused by the presence of various resins and an alkaloid called piperine.

The islands of Java and Madura furnish most of the pepper used in American homes. The United States buys almost 25,000 tons of this spice annually.

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Peg Hayward, long associated with the guide training program for Boettcher Memorial Conservatory, writes "Focus On" as a regular feature of *The Green Thumb*.



Piper nigrum – Pepper

The Green Thumb — 40th Anniversary

A time of transition describes the years 1954 — 1963 in our 40th Anniversary review through pages of *The Green Thumb*. During this vital period the publication, the voice of Colorado Forestry and Horticulture Association, became the voice of Denver Botanic Gardens, Inc. when the Botanical Gardens Foundation of Denver merged with CF & HA in 1960.

From an 8-page pamphlet, by 1954 the magazine had grown to one of 32, even 56 pages per issue and from six issues to 12 issues a year. Since its beginning, articles by national authorities as well as articles by regional horticulturists, botanists, gardeners, environmentalists and historians prominent in their fields were published in the magazine.

Its pages announced the start of numerous societies—rose, orchid, cactus, landscape architects and more; the Botany Club and the important Gardens' volunteer support groups. Activities of the Men's Garden Club, Swingle Study Group, Colorado Federation of Garden Clubs were also recounted. Readers learned about the influence of CF & HA in promoting a State Parks Board, roadside parks and designating botanical preserves including our outpost on Mt. Goliath, established in cooperation with the U.S. Forest Service.

In 1954, at Editor George Kelly's request, a 15-member editorial committee was formed to assist in obtaining contributions: topics, authors and artists. With M. Walter Pesman as its first chairman the committee

functioned with varying degrees of responsibility and has been, in effect, the stabilizing factor in the life of the magazine. Throughout its 30 years the committee has accepted the obligation that the magazine must go to press with or without an editor. The magazine, conceived as an educational device and effective membership tool, stressed practical solutions for beautifying our home and commercial landscapes and emphasized that horticultural practices in this high plains, semi-arid environment are different.

In 1951 the Botanical Gardens Foundation of Denver offered a plan to the City to develop 100 acres surrounding the Museum of Natural History at City Park. Fred Johnson accepted the presidency of CF & HA and Mrs. John Evans (Gladys Cheesman) moved to the presidency of the new Foundation. Officers and staff of both organizations assisted each other and the magazine recorded their activities, plans and achievements and offered tangible continuity between the organizations.

After Mr. Kelly returned to his nursery, The Cottonwood Garden Shop, Patrick J. Gallavan became director of CF & HA and editor of the magazine, responsibilities he retained until the organizations merged. In 1956 an entire issue was devoted to the Botanical Garden at City Park with its Lilac Lane and imposing rose garden, the Rainbow Iris Garden, fern collection, crabapples and the pinetum. Robert Woerner, full time director of the Gardens, had a

regular feature in *The Green Thumb*.

Unfortunately, by 1958 vandalism had become a serious problem and Horticulture House would soon be demolished to make way for the University of Denver Law School.

Meanwhile Dr. and Mrs. James J. Waring purchased Botanic Gardens House, a memorial to Mrs. Waring's father, Henry M. Porter, as a headquarters for Denver Botanic Gardens. It was adjacent to an 18-acre tract on the old cemetery grounds which would be developed as an herbaceous unit, part of Denver Botanic Gardens.

Ground breaking ceremonies were held at the new site on March 23, 1959 and soon after CF & HA moved into rooms near the second floor landing of the

House. The herbarium was carefully tucked into linen closets nearby. The library was set up in the former owner's library. July 1 Dr. A. C. Hildreth became director of Denver Botanic Gardens in its new facility.

The November-December 1960 issue of *The Green Thumb* announced the two organizations at last were one with Lawrence Long, president. And Mr. Pesman wrote, "*The Green Thumb* will be continued. . . It is my dream that it will grow in stature and significance in the same proportion as the growth of the population." The Editorial Committee and the membership, now members of Denver Botanic Gardens, shared the same dream.

BEP



AT LAST WE ARE ONE! Presidents Lawrence A. Long, Denver Botanic Gardens, and Scott Willmore, Colorado Forestry and Horticulture Association discuss merger documents in 1961.

Weather and the Rocky Mountain Gardener

by Anna R. Garrey

It's more than seventy-five years now since Richard Jeffries walked through English meadows to observe and record in minute detail the terrain he covered. Even differences of climate in a single field were noted and set down in a timeless record.

The average lay gardener makes no notes on trial and error, on climate, or on weather as the planting seasons come and go, and yet, over the years, experience teaches many lessons.

What shall we do specifically about weather, and climate?

In this particular region, outsmarting the weather and cooperating with climate may become one of the most intriguing sports imaginable. It is open to all ages, sex is no barrier, and it's an all season affair.

If you outwit the two (weather and climate), you will enjoy them and let them play no tricks on you. Then you can smile and say; — "Yes, we have a divine climate, but isn't our weather 'awful'?"

The late Anna R. Garrey is remembered as one of the founders of Denver Botanic Gardens. For many years she was intensely interested in establishing a botanic garden in Denver. As chairman of the first Arboretum and Botanical Garden Committee of Colorado Forestry and Horticulture Association, formed in 1944, she began the project which resulted in the organization of Botanical Gardens Foundation of Denver.

Mrs. Garrey was an original member of the board of trustees of Denver Botanic Gardens and served in that capacity for many years. She appreciated the important work of volunteers and supported the program in

With this in mind, I should like to set down some of the things I've discovered about this sport over a good many years.

It's a good thing to begin, minutely, in one's own door-yard, for, in an incredibly small footage, there are definite and defined variations of climate here in the amazing Rocky Mountain region.

Shade, which in the East is moist and warm, here is cold and dry. The sun on a southern exposure has almost burning-glass intensity. Shade and sun, therefore, may become assets or liabilities.

Your tulips, for instance, planted to the south will bloom fully two weeks before those in heavy shade to the north. This means a greatly extended period of bloom for the same flowers, planted at the same time, but in different locations. Recognizing this fact and making use of it adds several points to your score.

You long for lovely potted plants on your sunny terrace. Unless you are meticulous in the extreme, you end by

many ways, often working as a volunteer herself. Even after she could no longer be active, Mrs. Garrey remained keenly interested in the Gardens.

Enthusiastic about gardening and improving gardens in this area, she was a founding member of the Garden Club of Denver and active in the club for many years. Her interest in civic affairs was also reflected in other undertakings, including service as a long-time member of the board of directors for the State Home for Dependent Children.

This article first appeared in *The Green Thumb*, 13(3):12-14.

having "fried geraniums." Some of us would even forego potted plants on the stone floor of a hot area near the house. Your recognition of this situation, however, is another score in your favor.

You have learned not to crucify an espaliered tree on a western or a southern wall. You may even have decided to forego one altogether.

Next, perhaps you have observed your thermometer on some April morning when you have stepped out to a snowy corner of your garden. It may have recorded thirty degrees. To your astonishment when you came out two hours later, the snow had disappeared and the temperature was eighty, for, by this time, the sun had traveled to your corner.

It takes some stamina for a plant to adjust to such temperature fluctuation in so brief an interval.

I was told by one of our most distinguished growers of

evergreens . . . that on November 5, 1950, the temperature in Denver was 61. On November 6th, it was 10 below zero.

During the particularly delightful autumn-summer season of that year the trees had had no chance to harden because of the mild weather.

In addition to the abrupt temperature change mentioned above, during the following February the thermometer registered 25 below zero in Denver, and 50 below in the nearby mountains.

These profound ranges of temperature are happily quite infrequent, but they must be reckoned with in planting, as we must also consider the sharp contrast between our night and day temperatures in summer, which prove such an asset in our personal comfort.

Chinook winds bringing warmth and dryness to the winter scene, and sudden hail storms which mar mid-summer's beauty, cannot be ignored either.

The answer to all this is a fascinating

Denver is . . .

The Climate Capital of the World

more than 300 days of sunshine a year

The Denver Post May 11, 1984

*Snow, winds
punish West*

Sat., May 5, 1973

THE REGION

Summer-like heat wave may reach 85

warm, sunny summer days.

Bitter cold during December week

Landscape plants suffered injury

Climate: Colorado enjoys a beautiful, mild, dry climate with over 300 days of bright sunshine a year. In winter, Denver is mild, dry, and relatively snow-free while the world's best skiing is located in the mountains just two hours away; in summer, both Denver and the mountains offer cool, natural air conditioning.

THE DENVER POST Wed., March 18, 1970

Cold Fall Caused Many Trees to Die

SUNDAY, APRIL 22, 1984

Rerun of winter

golfers on Denver's courses
in February

Sun, showers renew spring

spring and autumn
days are usually balmy and
sunny, and the evenings cool.

A Dry, Comfortable Climate

December
holiday shoppers strolling the
streets in sweaters.

**16 Inches Reported
In Under 5 Hours
Near Castle Rock**

question rather than an answer. What to plant? This question involves your own experimentation and observation, aided by visits to those wise growers who have lived in this part of the country for many years.

The above mentioned problems unlock the secret as to why altheas, weigelas, red-bud, dogwood and many other familiar and delightful plants might live here for one year, or even for five years, only to perish on some unexpected night when there is a temperature drop beyond their tolerance, a long winter drought, or a late spring frost.

You score a point when you learn to make the proper substitutes for some of these old friends, perhaps among the viburnums, cotoneasters, privets, or lilacs, though the last may miss a flowering season now and then.

Look at the picturesque, corky, deep clefts of the cottonwood boles. No February sun could split the bark of this wise old native. He never unfolds his leathery leaves till danger of late spring frost is over.

We know, on the other hand, that the smooth bark of the lovely lindens (European or American) or the beeches, must be protected against the penetrating rays of our winter sun, otherwise they will split open. We begin to know why we so seldom see a sugar maple or a broad-leaved evergreen.

This background of experience, which is based on time and on human labor, is extremely meager here because we live in a new countryside. We have not, therefore, touched beyond the fringe of crops which may be grown or ornamentals we may use.

The high altitude laboratory at Climax, Colorado, where cosmic rays are being studied, challenges the imagination when one thinks of the cosmic ray in relation to plant mutation.

There is no miracle of spring in this mountain and plain country, for we pass almost instantly from winter to summer. Our winter-kill comes, ironically enough, well toward the spring, when, after cloudless days, sun drenched and lovely,

which have coaxed out incautious leaves, we may have sudden, killing frost.

Briefly then, our rainy season is a "snowy season" instead, due to the altitude and to the proximity of the mountains. Much of our moisture is to be expected in March and April. Late spring frosts are in order, so that we do not set out our tender annuals till the end of May.

We must be mindful of our extreme range of temperature. For the most part, however, we expect and get sunshine, penetrating, even dessicating. This suggests occasional winter irrigating for we live in a semi-arid region that depends on water from the mountains to augment our limited amount of rain or snow.

To sum up, our climate, year in and year out, is divine, — or so we think. Enjoy it to the full!

Our somewhat erratic weather may be atrocious and that, just at the wrong moment. Yet, we gardeners have learned to score against these lethal vagaries by careful selection of our plant materials.

We make our most triumphant successes in the game of outwitting the weather by the proper placing of the less rugged strangers we wish to introduce into our gardens. Some will be placed to the north and some in a sheltered corner. In such locations a red-bud, or a magnolia, may surprise us.

And always in view, there is the great barrier of the mountains, where in an hour, we may go from summer back to spring, or from early autumn on to deepest winter as we reach the austere heights above.

Inscrutable, serene against the vast horizon, white under the snow-pack of early winter, veiled in the silent mystery of the fast falling snows of spring, shining, glistening in the sun, the mountains remain — lifegiving or life withholding — in their gift of water to a thirsty land.

Who then shall record the secrets of this noble, vast, and challenging terrain, as Richard Jeffries once, long ago, captured the fine essence of the tiny fields of England? ❀

Propagation by Division

by Bill Lucking

Perennials, "old reliables" in any garden because they come up year after year from the same root stock and require a minimum of care, are easily increased by division. And this is a necessary, periodic chore if they are to be kept vigorous.

Divisions can be made almost any time during the growing season, but a good rule of thumb is to divide fall-flowering plants in spring and spring-flowering plants in fall.

How to Divide

To begin with, divide only healthy plants. Those that are really old and have lost their vigor are not particularly good subjects. Perennials which separate easily are: shasta daisies, hemerocallis, pyrethrums, phlox, chrysanthemums, campanulas, asters, and lilies-of-the-valley. Dig these with a fork and gently pull them apart. Always make sure the soil is moist for this operation, otherwise there will be too much root damage.

More difficult of division are woody-stemmed plants such as fall asters and certain varieties of phlox. These must have their stems split down their entire length and through the roots in order to be divided.

When dividing anything trim off all dried leaves and decayed matter and if the roots are exceptionally long, trim them back a bit. Then divide the clump by cutting off a section at a time with a sharp knife. Peonies are perhaps the trickiest. Dig them in the fall and dig deep enough to get the whole root system. If the plant isn't too old, several new ones can be made from it. Shake off as much soil from the roots as possible, then rinse them with water. Again, use a sharp knife when cutting the plant apart. Each section should have three to four good roots (which look almost like tubers) and two to three good eyes (or buds). If the roots are quite long, they can be cut back some.

A native Denverite, Bill Lucking has devoted a lifetime to growing plants. For 17 years he managed Roberts Nursery, growers of ornamentals, in Littleton; and for another 17 years he was superintendent of the Denver City Nursery. Considered a genius in his profession, he was called for advice by anyone — amateur or professional — who had trouble reproducing a specimen plant. He was instrumental in propagating many of our native plants commercially.

Mr. Lucking was a longtime member of the board of directors of CF & HA, was an integral part of the plant auctions and shared his

horticultural knowledge with volunteers staffing DBG's annual plant sales. The Denver Mens' Garden Club honored him on several occasions. He was an expert at many garden tours over the years and his beautifully landscaped residence has been featured on tours of various organizations. In their mid-80s, the Luckings recently retired to condominium living.

This reprint is one of four articles by Mr. Lucking on Plant Propagation Practices which appeared in *The Green Thumb* during 1959.

BEP



Fig. 1. Digging clump of peonies.



Fig. 2. Dirt and decayed matter is cleaned off.



Fig. 3. Sharp knife is used to cut peony root in sections.



Fig. 4. Divided peony with buds on each section.



Fig. 5. Roots are cleaned up ready to be planted.



Fig. 6. Overgrown shasta daisy clump.



Fig. 7. Divided clump of shasta daisies.



Fig. 8. Individual fall aster with stem split and ready for replanting.

Off-Shoots

New plants can also be propagated by off-shoots which are new shoots that come up from the roots of the old plant. Lilacs have lots of these side shoots — especially when they are planted in good soil. If the whole bush is not going to be dug up for division, cut off new shoots with a sharp spade by digging down between the parent shrub and the side-shoot. Other plants which lend themselves to this type of propagation are: snowberry, spirea, sorbaria, mahonia, and potentilla (cinquefoil).

Layering, Grafting and Budding

Of the three, the last two can be dispensed with quickly, for grafting and budding in this part of the country should be left to experts who have not only the knowledge, but the proper facilities. Rocky Mountain climate is too dry for amateurs to try these tricky processes.

Layering, however, is relatively simple. Simply bend a branch or twig down to the ground and cover the base of it with soil kept uniformly moist. It should be left attached, for at least a year, to the parent to develop a good root system before it is severed into a separate plant. Easy ones to experiment with are dogwood (*not* the flowering variety), forsythia, honeysuckle, grape, and clematis.

Propagation . . . can be an interesting, satisfying hobby. All you need are two "P's" and a "K" — patience, practice, and knowledge. Good luck! ♀

Thank You, Pete

by Josephine Robertson

Bernice (Pete) Petersen, who resigned in March after heading the Editorial Committee for the past fifteen years, has had a close connection with Denver Botanic Gardens since its early days.

When she was a journalism student at the University of Colorado in Boulder her "beat" was gathering news from public buildings. In the basement of the Post Office was the Forest Rangers' office and she came to know L. C. Shoemaker, author of *The Saga of a Forest Ranger*. The Black Hills beetle had invaded Colorado and was threatening our forests. He described its severity and provided her with other news stories. A decade later their paths crossed again, when after his retirement, he became office manager of Horticulture House.

It was the Great Depression when Pete went to the University. She worked her way waiting tables for "Captain Bly" Curtis at the women's dormitory, writing for the *CU Alumnus* and assisting in the alumni office for Anne McLaughlin, later Mrs. Everett Long of Long's Iris Gardens and a member of the Editorial Committee.

She worked as a reporter for *The Englewood Herald* at various times, as a clerk in Yellow Pages for Mountain Bell, and during the war as a bookkeeper and payroll clerk for Public Roads

Administration although she had never had bookkeeping nor seen a bookkeeping machine. The fact that she was always ready to tackle something new may account for her cheery willingness, through the years, to volunteer for any job that needed doing at the Gardens.

Coinciding with her "retirement" from Public Roads in 1948, newspaper publicity announced a headquarters for Colorado Forestry and Horticulture Association at 1355 Bannock Street with Mr. Shoemaker, secretary-treasurer. Her admiration for him during her student days sparked the idea that this must be a fine organization—for \$2 she joined. She enjoyed using the library at Horticulture House. One day when she came to borrow books there she found three women stuffing envelopes and offered to help. They said "Sit down!" and she has been helping ever since.

George W. Kelly, horticulturist and nurseryman, was director of CF & HA and editor of *The Green Thumb*. Pete volunteered to type, answer telephones and even began taking assignments for articles, always learning about gardening and botany as she wrote. Frequently she ghost-wrote for experts too busy or hesitant to write. She helped at the "Look and Learn" Garden Tours, at the first Garden and Home Shows and in the library, again learning as she went.

In 1954 at Mr. Kelly's request the Editorial Committee was formed with M. Walter Pesman as chairman. Mr. Pesman thought the magazine needed a touch of humor and asked Pete and the

Josephine Robertson, a former member of the editorial committee of Denver Botanic Gardens, has frequently written on subjects relating to the Gardens' history for *The Green Thumb*.

late Polly Steele to consider a regular feature. This was "Pete Ponders," a column with answers to mythical questions illustrated with Polly's delightful cartoons.

Some of her other editorial contributions include collaborating with Bill Lucking on the monthly "Gardening Tips" for the *Green Thumb Newsletter*; with Dr. Helen Zeiner in editing the magazine; with Suzanne Ash, producing *A Catalog of Rock Plants and Ground Covers*; with Louisa Ward Arps who wrote a history of the land around the Gardens combined with Pete's 25-year

history of DBG in *Cemetery to Conservatory*; creating the title "Tropics to Tundra" for the popular informational brochures. She helped to establish the Annual Plant Sale in its present format often preparing publicity for plant sales, holiday sales, special events at the Gardens and for the Associates.

Her great concern in publications of the Gardens has been quality of writing. She wants sentences to be concise; information, accurate; and names, correct. Perhaps this is why, when many volunteers were recognized for their outstanding services in 1973 and she was



Celebrating forty years of The Green Thumb and thirty years of Editorial Committee are Dr. Helen Marsh Zeiner, Bernice Petersen and Dr. Moras L. Shubert. All three have been members of the committee since its establishment in 1954.

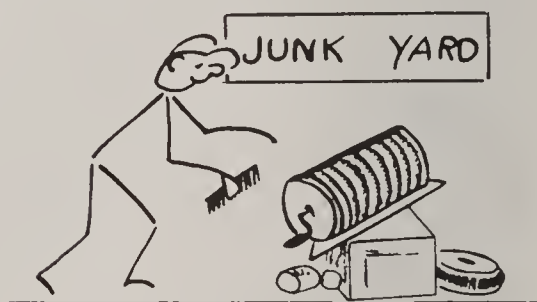
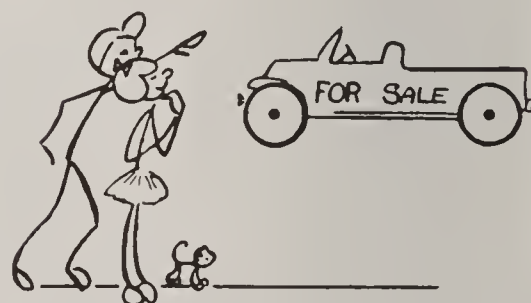
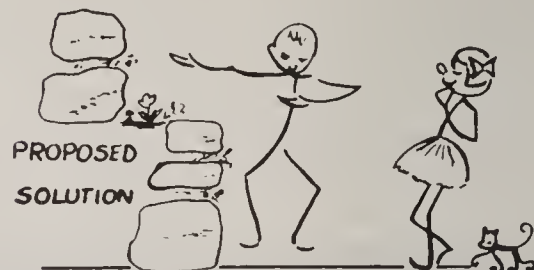
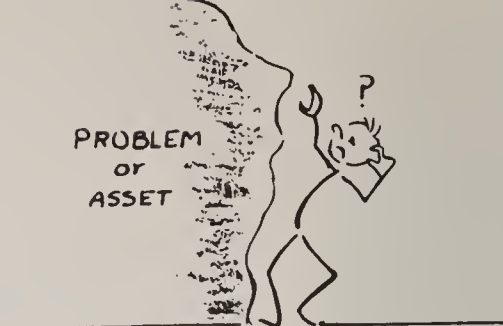
named Honorary Editor she often refers to herself as the "ornery editor." Through all Pete's endeavors there sparkles a bright sense of humor.

In the framed Certificate of Appreciation, presented at the annual dinner on behalf of the trustees, staff and members, her long and devoted service is recognized. It states, in part, "The true measure of the gift which you have so generously given is to be found in the esteem and gratitude of all of us who have been privileged to work with you."

She feels that among her rewards for years of volunteering has been her privilege of learning from and sharing the lives of so many dedicated and noteworthy individuals: Dr. A. C. Hildreth, distinguished director of DBG; George and Sue Kelly, outstanding horticulturists and authors; Walter Pesman, a founder, teacher and landscape architect who planned our roadside parks; LeMoine Bechtold, nationally known hybridizer who developed the first spider daylilies and primary contributor to our iris and hemerocallis collections; S. R. DeBoer, considered the father of DBG and pioneer city-planner; Katharine B. Crisp, prominent naturalist, teacher and author; Anna Garrey, the driving force for a botanic gardens in Colorado—her list of memorable associates is endless.

In the future Pete will continue to help at the Gardens but without time-consuming responsibilities. Now she will have more leisure to share with her husband and to enjoy their "did-it-themselves" garden of native plants and rocks. Looking back over all these busy years she reflects, "I think volunteering at the Gardens has been my vocation."

Thank you, Pete!





The Petersen's "did-it-themselves" garden. Read all about it in "Rocks on Our Knob," The Green Thumb, March-April 1957.

How About A Purple Lawn?

by Helen Stiles-Wainwright

Violets in the grass or grass in the violets? Whether violets are a nuisance or a welcome addition to the lawn depends on your point of view. In our harsh, unpredictable Rocky Mountain climate, where a good stand of bluegrass is hard to maintain, my husband and I have discovered a more satisfying easy-to-handle ground cover. Violets are hardy, pretty, smell good, and require just about no care. What's more, they've taken over good chunks of the lawn already and we've encouraged them to spread.

It started when we stopped using fertilizer containing herbicides on the lawn. The herbicides never worked very well; we still had magnificent arrays of dandelions and bindweed which we halfheartedly dug out. Our neighbors,

who cheerfully put up with anything which chanced to grow in their lawn, defeated our purpose anyway. We noticed, though, that under the barberry hedge which separates our properties, deep blue-purple violets were growing. If we didn't mow them, the plants grew 6-8 inches tall and produced large, fragrant blooms which we picked for bouquets. As we extracted the dandelions, we would stick in a runner from a violet plant which generally took off and spread into the adjacent "grass."

After some years of no herbicides, the violets had grown several yards across the lawn beyond the hedge and they showed up in various other spots all over the yard. They survived being walked on, and mowing never daunted them. If the mower was set at least a couple of inches high, it rolled over leaves and flowers with minimal damage. We watered the lawn, as one must do in Colorado to have any grass at all, and the violets stayed green all year long whether under the snow or exposed to sun and wind. Our

Helen Stiles-Wainwright, retired librarian and former editor of *Trails and Timberline*, the Colorado Mountain Club magazine, lives in Boulder. She does free-lance writing primarily on nature subjects.



violets started to bloom in sheltered spots in early March, sometimes almost at the edge of a snowbank. From April through mid-May, they formed a glowing, deep purple carpet across a large swath of the lawn and we could smell them the minute we opened the front door.

In addition to this sweet-smelling purple violet (*Viola odorata* L., an import), a pink violet, transplanted by chance with a bunch of iris, is also spreading through the grass. This one tends to grow in clumps and doesn't produce runners quickly except beneath the bird feeder where it gets lots of natural fertilizer. A large, ornamental, white variety scarcely moves from the flowerbeds but makes a nice border in spring.

Violets belong to a large family of plants, the *Violaceae*. Other common representatives are pansies and Johnny-jump-ups. These plants produce runners or stolons which grow beneath the grass and leaf-litter and send down roots to produce new plants. Violets also produce abundant seeds. These come from a second flowering of inconspicuous, petal-less, self-fertilizing blooms occurring in summer. On a warm

morning, as the pods dry, you can see the seeds pop out—another way by which the plant spreads considerable distances.

If you plan to grow violets in profusion, choose a variety that thrives in your locale. Some prefer sun, others shade. Some will grow in poor, acid soils, others like damp ravines and bogs. Ours seem to get along just fine in our alkaline, clay soil. We find the largest, deepest-colored violets under the hedge or at least in partial shade, but they'll grow and spread in full sun.

Our backyard slopes off to an open field and sporadic stream bordered by cottonwoods. From this somewhat natural area, mowed once or twice a summer, such weedy plants as bindweed, salsify, curly dock, prairie sage, yarrow and red clover creep into the yard. After years of struggling to keep the intruders out, we decided to pull the worst of the weeds, plant a lot of white clover, and encourage the violets. While we haven't taken the drastic step of actually ripping out the grass, we have stopped worrying about its condition and begun to enjoy the violets — a nice way to keep your sanity in a weedy world. ✱

Pyrolas and Related Plants Native to Colorado

by William F. Jennings

A large family of plants with world-wide distribution, the heaths contain 18 recognized species in Colorado. Among the best-known members of the family are rhododendrons, azaleas, heathers, blueberries, and cranberries. Of these, only *Rhododendron albiflorum* Hook and three species of *Vaccinium* (blueberries) are recorded here.

Some heaths are shrubby and tree-like; others are ground covers; some are evergreen. The family is so diverse that some botanists split it into two families: the shinleafs (Pyrolaceae) and the heaths (Ericaceae). This treatment neatly divides the 18 Colorado species into two groups of nine each. Those in Ericaceae are all woody plants, the Pyrolaceae all herbaceous; but most have evergreen leaves.

The nine species of Pyrolaceae include members of six genera: *Pyrola*, *Ramischia*, *Moneses*, *Chimaphila*, *Pterospora*, and *Monotropa*. All but one, *Pyrola*, have but a single representative in Colorado.

Pyrolas

Probably the most common of the pyrolas is pink pyrola or common shinleaf, *Pyrola asarifolia* Michx. Quite striking when first seen, this plant can be found from about 7000 feet elevation to timberline on cool, damp, north-facing slopes; alongside small brooks; and in bogs and other moist

spots. The single stalk is about 9 inches to a foot tall with numerous downward-facing umbrella-shaped flowers that can vary in color from a very pale pink to rich cranberry red. The deep-red-flowered plants are scattered widely in the mountains but are particularly noticeable near Squaw Pass. In addition to the raceme of pink or red flowers, the species is characterized by elliptic evergreen leaves the size of a 50-cent piece or larger on long stalks or petioles arising from ground level. The style is bent in an S-shaped curve and projects visibly from each flower. Examination of this feature, necessary



White-veined pyrola — *Pyrola picta*

William F. Jennings, a professional engineer, has studied and photographed many Colorado wildflowers.

for identification of the pyrolas, nearly requires standing on one's head.

The other three Colorado pyrolas are variations on the theme set by *P. asarifolia*. *Pyrola chlorantha* Swartz (syn.—*P. virens* Schweig. ex Schweig. & Koerte) is found in similar habitats, but its flowers are greenish-white. The flower stalk is a deep olive, almost brown, and leaves are no larger than a 25-cent piece. Look for it on cold, mossy, north-facing slopes at about 9000 feet in July.

Pyrola picta Smith is rare in Colorado, reportedly from the foothills near Boulder and Colorado Springs. Its most striking feature, its mottled and veined evergreen leaves, makes it identifiable at all seasons. Distinctive also is the red flower stalk with creamy-yellow flowers. While the cranberry-red-flowered version of *P. asarifolia* is probably the most attractive of the pyrolas, *P. picta* is a close second.

Pyrola minor L. is generally found only in moist areas of the subalpine region, particularly along the nature trail on the south side of Long Lake west of Brainard Lake. The smallest of the four true pyrolas, it seldom exceeds 5 inches in height. The leaves on long stalks are the size of a dime or even smaller. The flowers, white or very pale pink, are more spherical than the other Colorado pyrolas which tend to look like miniature umbrellas. *P. minor* is the only Colorado species of the genus with a straight style. Effective photography of this little gem usually leads to well soaked knees and elbows and a crook in the neck.

Ramischia

Ramischia secunda (L.) Garke (syn.—*Pyrola secunda* L.) is a most distinctive member of Pyrolaceae since all its flowers are on one side of the flowering stalk ("secund" in botanical terminology). Its glossy evergreen leaves are near the base of the plant, but not right at ground level as in the pyrolas. The stalk is arched and the greenish-white flowers with a straight style open only slightly. Fairly common, this woodland plant is also found on cool,

mossy, north-facing slopes from 7000 feet to timberline. Bloom follows the seasons: late June at low elevations to early August at higher elevations.

Moneses

Like the other pyrolas, *Moneses uniflora* (L.) A. Gray has a nodding flower that is nearly impossible to photograph and which can only be seen from ground level. A fragrant single white flower characterizes this plant that is no more than 5 inches tall. Its habitat is similar to previously mentioned species; in fact, it is not at all unusual to find several members of Pyrolaceae growing together. Commonly called wood nymph, it grows in moist woods from about 8500 feet to timberline. To photograph this plant search for one at the top of a stream bank and shoot upward into the flower.



Wood nymph — *Moneses uniflora*



Pipsissewa — *Chimaphila umbellata*

Chimaphila

Our species, *Chimaphila umbellata* (L.) Bart., is called prince's pine or pipsissewa. The flower looks a little like *Moneses uniflora* but has red anthers and pinkish petals. Each plant has several nodding flowers. The sharply-toothed oblong leaves are arranged in whorls around the lower stem. Another woodland plant, it can be found on north-facing slopes from 8000 feet to timberline, often on somewhat drier hillsides than other members of Pyrolaceae.

Pterospora

Pinedrops, *Pterospora andromedea* Nutt., is probably the most common and conspicuous saprophytic flowering plant in the West. Having no green leaves, a saprophyte derives its food from dead organic matter. After flowering it

becomes rather woody and hard and is very resistant to being knocked down by heavy winter snows. Sometimes growing to 3 feet or more, its brown stalks can be quite obvious even in mid-winter above the snow. The stem of pinedrops is generally reddish, purplish-brown or chestnut colored. Straw-colored and hanging vertically downward, the flowers are crowded at the top of the spike, becoming less so down the stem. When the topmost flowers are barely open, the lowest ones are already in seed.

Look for pinedrops in rich humus under the pines, generally in relatively moist situations or on north-facing slopes but sometimes in surprisingly dry situations. Usually one will find last year's dead stems before finding a live blooming plant. In Colorado pinedrops can be found virtually everywhere in the mountains from about 6000 to 10,000 feet blooming in August regardless of elevation.

Monotropa

Pinesap, a white, tawny or red saprophyte with similarly colored flowers but showing a little yellow inside, though not abundant, is widely distributed throughout the Rocky Mountains and much of the Northern Hemisphere. The plant was given its botanical name, *Monotropa hypopithys* L., by the great Swedish botanist Linnaeus more than 200 years ago. It may grow to a foot tall, but is usually shorter. The plant tends to dehydrate quickly in the dry August weather of the Rockies and can be crisped and brown and rather unattractive while blooming. During wetter years the plant retains its moisture and is much more attractive with bell-like flowers characteristic of many heath family members. The flowers nod, often hanging straight down, making photographing it a real challenge.

The plant could be confused at first with pinedrops; but the more common pinedrops should be an old friend by the time one stumbles upon pinesap. We have found pinesap in only one locality in Colorado: under the pines on north-facing slopes in Middle St. Vrain Canyon just



Pinesap — *Monotropa hypopithys*

west of Peaceful Valley at an elevation of 8700 feet. The plants were observed in three different years during the first week of August. H.D. Harrington reports that pinesap has been found in Douglas County south of Denver and in Mineral County in the San Juan Mountains of

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southwestern Colorado. W.A. Weber reports it as rare and endangered. These and other authorities seem to agree that its range is between 7000 and 9000 feet elevation in coniferous forests in the mountains just about anywhere in the West.

Finding all the Colorado species of Pyrolaceae offers a challenge to wild flower enthusiasts and an even greater challenge to wild flower photographers.

An article on the woody plants of the heath family that are found in Colorado will be printed in a future issue of *The Green Thumb*. ♀

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Page 47: Drawing by Phil Hayward
Page 58-59: Drawings by Polly Steele
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celebrating 25 years
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1959 — 1984

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For further information, write to Membership Chairman, Botanic Gardens House, 909 York Street, Denver, Colorado 80206, or call 575-3751.

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Velma A. Richards

Editor

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Denver Botanic Gardens, Inc., maintains a collection of living plants, both native and exotic, for the purpose of acquiring, advancing and spreading botanical and horticultural knowledge.

This is a non-profit organization supported by municipal and private funds.

The Green Thumb— 40th Anniversary

by Bernice E. Petersen

The years 1964 to 1973 were exciting ones at Denver Botanic Gardens as dreams of its founders neared reality.

Construction of Boettcher Memorial Conservatory began in January 1964. Soon the wooden forms for this concrete and plexiglas structure loomed like the rib cage of a giant dinosaur against the brilliant Colorado sky; volunteers on the Editorial Committee and other support groups of the Gardens realized their responsibilities and capabilities were being challenged dramatically.

This was a decade of intense building activity for in 1971 Boettcher Memorial Center housing the library, herbarium, lobby court, horticulture hall, classrooms and mycology laboratory was dedicated and the Gift Shop moved into its permanent setting.

Outdoors the Herb Garden was dedicated. Gates Memorial and Lew Hammer gardens had been constructed earlier and were described in the magazine. Test trials of annuals, bulbs, gladiolas and other plantings were under way. The Children's Garden program had begun, a master plan for redeveloping the Gardens was accepted and an \$850,000 development fund drive was started.

Bernice Petersen, a graduate in journalism from the University of Colorado, has been a member of the Editorial Committee since its beginning and served as its chairman for 15 years.

Additionally, plans for an arboretum and environmental study area near Chatfield Reservoir were approved by the Army Corps of Engineers; land for the Walter S. Reed Botanic Garden in the montane zone near Evergreen had been given and the M. Walter Pesman Trail on Mt. Goliath was developed with the cooperation of the U. S. Forest Service.

The Green Thumb recorded these achievements. It reviewed histories of Denver's parks, spotlighted native cactuses, roses, a second national convention here of the American Iris Society and marked the 25th Anniversary of *The Green Thumb* in a year-long celebration.

Although the Gardens were expanding in every direction, for budgetary reasons the number of issues of the magazine decreased from eight a year to six and finally four corresponding with the seasons. Meanwhile the *Green Thumb Newsletter* had begun in 1963, part of a membership project of the DBG Guild; its goals: to stimulate interest in current developments on York Street and to furnish timely tips for home and commercial gardeners. Two years later editing the leaflet and providing gardening tips reverted to staff and the Editorial Committee, whose members also represented the conservatory, library, herbarium, landscape architects and Colorado Federation of Garden Clubs to ensure

coverage of every aspect of the horticultural and botanical community.

What had begun as a plant auction in 1949 gradually evolved into the Annual Plant Sale as it is known today and the magazine heralded the event with a plant sale issue of the magazine in 1964. Soon after the conservatory opened in 1966 the first Conservatory Plant Guide was an issue of the magazine. The guide was revised the following year and sold as a separate publication. In 1971 an entirely new guide was published.

Regular features in the magazine included lively essays on insects, "Exotics of Colorado," plants popular for our landscapes; "Focus On," tropical and subtropical plants of the conservatory; "The Latchstring is Out" to botanical gardens throughout the nation. Begonias, African violets, gesneriads, hostas, mushrooms, lilies, daylilies, as well as hanging baskets and bottle gardens were among the topics.

Books and booklets published included *What Tree Is This?*, a simple key for tree identification in the Denver area and *Meet the Natives*, Pesman's guide to wildflowers, both offered in the Gift Shop.

The "Director's Report" became an "Annual Report" and finally was separated from the magazine in 1973. Wildflowers of Mt. Goliath were pictured in the magazine, informational signs were erected at the head of the Pesman Trail and a Mt. Goliath folder was made available in our Gift Shop and at the Forest Service Ranger Station at Idaho Springs. The *Tropics to Tundra* brochures were devised and distributed to the Visitors Center and at Stapleton International Airport.

During these growing-up years, twenties for the magazine and teens for the Editorial Committee, more than a dozen editors had been pressed into service—staff, part-time staff and volunteers. Under Dr. William Gambill's directorship, a part-time

staff person, Margaret Sikes, edited the magazine until her appointment as education-specialist when editing the *Green Thumb Newsletter* became her province and Dr. James Feucht offered to do "Garden Hints."

Wes Woodward, a retired civil engineer and former journalist, edited *The Green Thumb* and the *Annual Report* as part-time staff. He translated Frances White Novitt's transcriptions into "Plans, Parks and People," a tribute to S. R. DeBoer, 80 pages of history within a single issue of the magazine, December 1972. The story behind Chatfield Arboretum was told in 1973.

True to his engineer's training Mr. Woodward surveyed the issues of *The Green Thumb* from 1962 until his appointment in 1972. In "Makers of the Magazine" he reported that of 529 signed articles published, over one-third of those were written by members of the Editorial Committee: "It's plain to see that these dedicated people, so involved and so concerned with our magazine have made it and maintained it and continue to strengthen it, regardless of printers and editors who may come and go." ♣

BEP



Clematis for Colorado

by George W. Kelly

The fact that there are several species of clematis native to Colorado has led us to believe that others, from similar climates, might also thrive here.

Through experimenting and modifying some of our cultural methods we may discover which of these foreign species can be made to "feel at home" in Denver. All clematis seem to like to have their "heads" in the warm sun and their "feet" in cool soil, so we try to arrange a spot for them where the soil is loose, moist and shaded by other plants or buildings. Peat and sand added to ordinary good soil, if it is in a well-drained location, will make a good medium in which to plant clematis. Watering will be easy and little additional fertilizer will be needed if the soil is properly prepared.

The clematis that can be grown in Colorado may be divided into four general classes: small-flowered vines, medium-flowered vines, large-flowered vines and the non-vining types.

Mr. Kelly was one of the founders of Colorado Forestry and Horticulture Association, was its director and editor of *The Green Thumb* during its first dozen years. He was a charter trustee of Denver Botanic Gardens and coordinated the activities of the City Park unit until a full time director was appointed.

Presently available as *Rocky Mountain Horticulture*, his first book was published in 1951 and has undergone several revisions and printings. *Woody Plants of Colorado* is a classic. Other books are on trees and shrubs, perennials, ground covers and native plants of the 4-corner states. His practical articles on horticulture have appeared in many national publications. Recently he launched a bi-monthly magazine, *Rocky Mountain Gardening*.

An early advocate of using native plants, he has planned landscapes at Marathon Oil and Martin Company near Waterton; he was consultant at the Air Force Academy

Small-Flowered Vines

Clematis paniculata, the sweet autumn clematis, is the most useful of the small-flowered species. An extremely vigorous grower, it will cover large areas of fences, pergolas and trellises in a few years. The flowers are small, white, profuse and delightfully fragrant. The fluffy seed heads, which follow the flowers, cover the plant and remain into the winter. This species usually dies back partially in the winter but will come up again vigorously with the advent of warm spring weather.

Clematis ligusticifolia is a native Colorado vine with flowers similar to *C. paniculata* but with larger seed heads and no fragrance. This species blooms in August or September, a month or so earlier than *C. paniculata*. It is also more tolerant of alkaline soil and hot winter sun than *C. paniculata*. A similar species, *C. virginiana*, is native in the eastern United States.

and has taught countless classes for home gardeners and commercial horticulturists.

As a conservationist Mr. Kelly crusaded for state and national parks and was instrumental in establishing DBG's outpost on Mt. Goliath, which is maintained in cooperation with the U. S. Forest Service.

About 15 years ago he and his wife, Sue, sold their Cottonwood Garden Shop in Littleton and "retired" to Cortez, Colorado where he continues to teach and write. Recipient of numerous regional and national recognitions, he recently celebrated his 90th birthday.

This article published in May 1964, Vol 21 (4): 116-117 and the one by Dr. A. C. Hildreth commemorate *The Green Thumb's* 40th Anniversary. The drawing is one of scores made by the late Polly Steele, a dedicated volunteer whose "career" as an illustrator and author for the magazine and newsletter began in the early 1950s and spanned a period of 25 years.

BEP



Medium-Flowered Vines

Some of the most interesting, if not the most conspicuous, species belong to the medium-flowered class. Of these, the scarlet clematis, *Clematis texensis* (*C. coccinea*), is probably the most attractive. It is a rather frail appearing vine, climbing to nearly 6 feet and is covered throughout the summer with small red, urn-like flowers that look as though they never fully open. Similar in habit is the curly clematis, *C. crispa*, with purple, bell-shaped flowers.

Clematis tangutica and *C. orientalis* are both very vigorous vines with open, yellow, star-like flowers, 2 to 3 inches in diameter. *Clematis orientalis* has escaped in places, notably in the vicinity of Idaho Springs and, for miles along the road and stream beds, has crowded out less attractive plants. *Clematis pseudoalpina* is a very frail vine which is found growing in the dense shade in our mountains. The flowers are generally a pale lavender but are sometimes almost white or purple. *Clematis montana*, a native of Asia, has rose-pink flowers which are borne on the previous year's wood. This species, like many others, dies rather far back during the winter. For this reason, it is not so well adapted to our climate as *C. pseudoalpina* which produces flowers on the current year's wood.

Large-Flowered Vines

The very conspicuous, large-flowered class is represented most frequently in Denver by the popular *Clematis jackmani*. We have found, in recent years, that we may greatly extend our variety of flower color and character available in this class if the proper soil situation and care are given. Included in

the popular purple varieties are: 'Gypsy Queen', 'Lady Betty Balfour' and 'Lord Neville'. 'Crimson Star', 'Ernest Markham', 'Mme. Edouard Andre', 'Ville de Lyon', 'Henry Chapin' and *C. jackmani rubra* are among the most popular of the red-flowering types. Of the white-flowered types *C. lawsoniana henryi*, with its big, flat saucers of bloom, is most often planted. Other white-flowered types include: 'Duchess of Edinburgh', 'Fairy Queen' and *C. lanuginosa candida*. Popular blue-lavender types are: 'Mrs. Cholmondeley', 'Ramona', 'Wm. Kennett', 'W. E. Gladstone' and *C. lawsoniana*. Included in the pink-flowering types are: 'Comtesse de Bouchaud', 'Mme. Baron Veillard' and the Hagley hybrids. 'Nelly Moser' and 'Belle of Woking' have mauve colored flowers.

Non-Vining Types

The non-vining clematis add a nice touch to the perennial garden. *Clematis recta*, which grows 3 feet tall and which is covered with small, white, star-like blossoms, is best known. Recently, the improved *C. recta mandshurica* has almost replaced the older species for use in perennial gardens. *Clematis heracleifolia davidiana* is a variety which has small, light blue flowers. It forms clumps approximately 2 feet tall and 2 feet across. The native *C. hirsutissima* (*C. douglasi*) grows about 18 inches tall and is covered with small, purple, bell-like flowers similar to those of *C. crispa*.

Provide the correct growing conditions for clematis and they will repay you with masses of beautiful blossoms. ♀

Dry Land Gardening On the Plains

by A. C. Hildreth

The last great region of our 48 contiguous states to be settled by the white man was the semi-arid Plains. The eastern boundary wavers between the 98th and the 100th meridians. Westward, the area extends to the Rocky Mountain foothills; northward, it reaches the Canadian border, and southward, the Pecos River and the south edge of the Edwards Plateau.

For decades, land-hungry people hurried across this barren expanse to settle in Oregon, California and Utah. Settlement of the Plains by farmers occurred mainly during the last twenty years of the 19th century and the first quarter of the present century.

Plains settlers came mostly from humid eastern and midwestern states. It took years of frustration and repeated crop failures to convince these determined pioneers that semi-arid farming is fundamentally different from humid-climate farming.

From trials and errors of these farmers and the researchers of Land-grant Colleges, state Agricultural Experiment Stations and the U.S. Department of Agriculture, there gradually evolved a whole new system of farming. It is peculiarly adapted to Plains conditions and involves special kinds of crop plants, unusual cultural practices and tillage machinery of uncommon design.

The name "dry farming" has been applied to this and all other farming systems carried on under strictly semi-arid conditions. This name

distinguishes these systems from irrigation farming and also from humid-climate farming such as that of our eastern and midwestern states.

In the Old World, dry farming was practiced in ancient and even prehistoric times. American Indians dry farmed in Pre-Columbian times. Plains settlers did not benefit from such early experience, nor were they aided appreciably by more recent dry farming experience in other semi-arid parts of the United States. The Plains dry farming system is an independent development of our Plains region. It was begun and brought to its present degree of perfection within less than a century.

While Plains dry farming was evolving, Plains dry-land gardening also was being developed, based largely on dry farming principles. In pioneer days, the utilitarian rather than the aesthetic side of horticulture was emphasized—fruits and vegetables for the table and trees for shade.

Early in this century the U.S. Department of Agriculture recognized the importance of gardening to dry farm families. Research on all phases of dry-land horticulture was sponsored at federal stations located in the northern, central and southern Plains. Projects involved trees and shrubs for windbreaks, fruits, vegetables and many kinds of ornamental plants.

Dry-land horticultural research was conducted also by state Agricultural Experiment Stations. Some of their work

antedates that of the federal government by many years.

Results of all these research efforts have been presented in various state and federal publications. They constitute a valuable segment of American horticultural literature.

Ironically, there are now fewer farm families interested in Plains dry-land gardening than there were forty years ago. One reason is, there are now fewer dry-land farmers. Small land holdings have been combined into larger, more economic units, resulting in larger farms but fewer farmers.

Also, with complete mechanization of dry farming, many Plains dry farmers now live in towns and "commute" to their farms. Furthermore, most of those who live on the land have installed water systems large enough to irrigate garden areas around their homes.

Recently, suburbanites of Plains cities have shown unexpected interest in dry-land gardening. Many are finding that, for one reason or another, they cannot irrigate all their acreage. Still they would like to make their unirrigated areas attractive. Hopefully, they are considering dry-land gardening as the solution of their problems.

Such individual problems foreshadow a similar general problem that will undoubtedly plague Plains cities in the future. As these cities expand they inevitably will be short of water. This means restrictions and priorities on water use. Gardeners are always first to feel the pinch of water restrictions.

Although most Plains cities still have untapped water sources, their development will be very expensive and the cost of water will be correspondingly high. With probabilities of restrictions on water use and high cost of irrigation water, it is safe to predict that in the not-too-distant future much more of the gardening on the Plains will be dry-land gardening.

Dry-land gardening is not difficult, but it is not merely neglect as some people believe. In fact, dry-land practices require accuracy of timing and quality of

performance comparable to those of irrigation gardening.

The all-important dry farming practice is alternate fallowing and cropping. Each year half the land is fallow and half is cropped. Fallowing stores moisture in the soil, giving the next crop the benefit of two year's moisture. Fallow land must be tilled often enough to destroy all weeds while they are very small, otherwise they will rob the soil of moisture, defeating the purpose of fallowing.

This alternate crop and fallow procedure was developed for annual dry-farm crops such as wheat, cotton and sorghums. Unfortunately, use of this practice in Plains dry-land horticulture is limited chiefly to annual flowers and vegetables, for which plantings it is very satisfactory.

Of course, dry land in permanent horticultural plantings, for example, windbreaks, screens, hedges, orchards, shrub borders and perennial borders cannot be fallowed. Before such plantings are made, however, a year or two of fallowing is advisable to insure plenty of moisture for starting the plants. This fallow period is also the time to eliminate by chemicals such perennial weeds as Canada thistle and bindweed.

Maintaining permanent dry-land plantings is largely a matter of controlling weeds that compete with the garden plants for moisture. On the Plains there is generally enough precipitation to grow either weeds or garden plants, but not both.

Weeds usually are controlled by cultivation. This operation is essentially the same as the fallowing done by dry farmers. The dry-land gardener, however, cultivates the same piece of land year after year and he must do this tillage work among permanent horticultural plants rather than in open fields.

Weed control in permanent horticultural plantings must continue until the garden plants are large enough to shade out the weeds. On the Colorado Plains, this often means cultivation throughout the life of the planting.



Dry-land farm with windbreak planted on contour affords protection to farmstead, feed lots and road.

After several years, however, trees and shrubs, particularly evergreen conifers, may develop sufficient height and density to shade out weeds, at which time cultivation should stop. Thickets formed by suckering trees and shrubs may maintain themselves without weed control but their growth will be slow.

In their zeal to control weeds, early Plains dry farmers and agricultural experts gave little thought to the long-term effect of their fallowing practice on the soil. To them, good dry farming meant fallow land, smooth as a billiard table, without a straw protruding above ground and a 2- or 3-inch layer of fine soil on the surface. Crop residues such as straw and stubble often were burned to make tillage easier.

The "Dust Bowl" era of the 1930's changed popular opinion as to what was desirable in fallowing. Dry farmers finally realized that the dusty surface

resulting from their faulty tillage implements was harmful, despite the "dust mulch" theory of soil moisture conservation which was in vogue the early part of the century but which later was proved invalid.

Farm implement manufacturers cooperated with state and federal agricultural specialists in developing better fallowing machinery. End results of their work are modern tillage implements that leave the surface of the soil rough and cloddy rather than smooth and pulverized. They also kill weeds without completely burying crop residues.

The rough, littered surface condition produced by such implements is called "trashy fallow." It reduces soil erosion, prevents soil crusting, increases water penetration into the soil and decreases moisture evaporation from the soil surface.

Of course, modern dry farm fallowing equipment is too large for cultivating dry land gardens, except for maintaining the important cultivated strip around the outside of the plantings. Garden-size tractors now are available to which can be attached small chisels and sweeps to make satisfactory dry-land cultivators.

Small rotary-type tillers used extensively in preparing garden areas for planting are not suitable for continual cultivation as they tend to pulverize the soil. Hand cultivation is satisfactory for small dry-land plantings.


The trashy soil surface so important to dry farmers is also important to dry-land gardeners. Unfortunately, horticultural plantings, particularly young trees and shrubs, return little organic material to the soil.

To obtain the desired trashy surface some kind of fibrous organic material must be brought in from time to time and spread lightly over the ground—wood or bark chips, wood shavings, straw, grass clippings or partly composted leaves.

Mulching often has been proposed as a

substitute for cultivation in controlling weeds in dry-land plantings. Certainly any means of reducing the work of cultivation would be welcomed by dry-land gardeners. Unfortunately, experiments on the Plains have shown that mulches of straw, hay or sorghum stalks, deep enough to prevent growth of weeds, will seriously damage or kill woody plants under dry-land conditions.

Do's and Don't's

1. Avoid shallow soils underlain with rock layers or gravel. Roots of dry-land plants need a large volume of soil from which to extract moisture.
2. Space dry-land plants wider apart than in irrigated plantings.
3. Fertilize dry-land plants sparingly, but incorporate organic matter generously into the soil.
4. Do not cut off lower branches of trees or shrubs to simplify cultivation. Such pruning admits light and wind, encouraging weed growth and increasing moisture evaporation from the soil surface. 

A. C. Hildreth, Ph.D., became director of Denver Botanic Gardens July 1, 1959 shortly after the organization opened its headquarters at 909 York Street. At the time the grounds on the York Street unit were undeveloped. In short order paths and roads were constructed, an irrigation system installed, test gardens of annuals and perennials established and the Children's Garden program was begun. Under his guidance Boettcher Memorial Conservatory was designed and constructed and the education building was on the drawing board.

In 1930 he was appointed superintendent of Cheyenne Horticultural Field Station where he was active in breeding superior ornamental and crop plants. Much of his professional life was focused on finding out how plants adjust to drought and cold and how to develop better horticulture in the high, dry, cold, bright climates. Among the notable examples of this painstaking work were the series of Cheyenne chrysanthemums, "alpine" tomatoes and strawberries. For 27 months prior to retirement from the U. S. Department of

Agriculture he organized and directed an experimental station in Afghanistan.

Upon retiring from Denver Botanic Gardens in 1966 he was named Director Emeritus, a title he actively pursued until his death in 1975. Among other recognitions were the Arthur Hoyt Scott Award for outstanding horticultural achievements on a national and international scale and the Liberty Hyde Bailey Medal; the citation reads, "A pioneer in developing suitable horticultural techniques for the Rocky Mountain States."

Dry Land Gardening on the Plains appeared in *The Green Thumb* 26 (4): 117-120, Autumn 1969. It was one of a series written by Dr. Hildreth which the Editorial Committee, the Board of Trustees and the Associates of Denver Botanic Gardens hoped would be combined into a book along with many articles he had written for the *Rocky Mountain News*. Unfortunately ill health halted that venture. However, Dr. Richard Hildreth, a son, presently is working on those papers.

Twenty-five Years Ago . . .

In 1959, the seeds were planted on York Street in Denver for what has grown into today's impressive Denver Botanic Gardens.

THE DENVER POST Mon., Sept. 21, 1959



MODEL OF NEW UNIT EXPLAINED

Clyde Learned, 988 S. Williams St., a member of the reception committee for dedication, shows Mr. and Mrs. E. P. O'Meara (left), 888 York St., a model of new unit.

What the visitor sees there today are the stems, foliage and flowers of the Gardens. The unseen root system reaches back one hundred years to the Colorado State Forestry Association (formed in 1884) and the Denver Society for Ornamental Horticulture (begun in 1916) which merged in 1943 to become the Colorado Forestry and Horticulture Association and to the Botanical Gardens Foundation of Denver, Inc. (started in 1951).

The first botanic garden was begun in 1951 within City Park in the vicinity of the Museum of Natural History. By 1958 it was apparent that this location was inadequate, and by 1959 the present site from York Street to Cheesman Park had been secured for the future Denver Botanic Gardens. In 1960 the Colorado Forestry and Horticulture Association and the Botanical Gardens Foundation of Denver merged to become Denver Botanic Gardens, Inc., and the sprouts of the Gardens today were beginning to appear.

\$300,000 Botanical Project Opens

Groundbreaking ceremonies were held Monday at E. 10th ave. and York st. for Denver's \$300,000 botanical gardens.

Flowers will be blooming by June 1, officials of the Botanical Gardens Foundation of Denver said.

The gardens will be on a 21-

acre site formerly Mt. Calvary Cemetery. The land has not been used for several years.

The gardens will be the only major botanical display between St. Louis and Los Angeles, officials said.

The ground was given to the foundation by the city last fall under a perpetual rights agreement.

The gardens, when completed about two years from now, will stretch from Cheesman Park to

Congress Park and will be bounded by E. Ninth and E. 11th aves.

More than \$120,000 in contributions have already been received and will go toward opening the first section of the gardens bordering York st.

The gardens will be open to the public. Headquarters for the foundation are at 909 York st.

Hiker Dies in Fall

CROSS ROADS, Calif., March 23—(AP)—Kildare Haddon, 17, of Glendale, hiking with seven companions, was killed Monday when he fell 300 feet from the top of Bareface Mountain.

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DEDICATION CEREMONIES FOR NEW UNIT OF DENVER BOTANICAL GARDENS.

Ceremony Opens Herbaceous Unit Of Denver Botanical Gardens

The herbaceous unit of the Denver Botanical Gardens was dedicated in ceremonies Sunday afternoon at the headquarters of the new area, 909 York St.

In his dedication speech, Dr. A. C. Hildreth, recently appointed director of the gardens, praised the cooperation between private citizens and the city in making the gardens possible.

Dr. Hildreth said the Botanical Gardens would not only become beautiful gardens and a tourist attraction, but also would be a repository for valuable plant material for research and study and an educational institution for formal and informal study.

"Denver has a great opportunity to develop a unique botanic garden because our high mountains have such a great variety of plants," Dr. Hildreth said.

He said the Denver gardens could grow arctic plants in the 65-acre area on the east face of Mt. Goliath, temperate area plants in the Denver gardens and tropic plants in a conservatory they hope to construct in the near future.

"Few cities in the world have such an opportunity," he said.

The new director also told the audience that Denver's Botani-

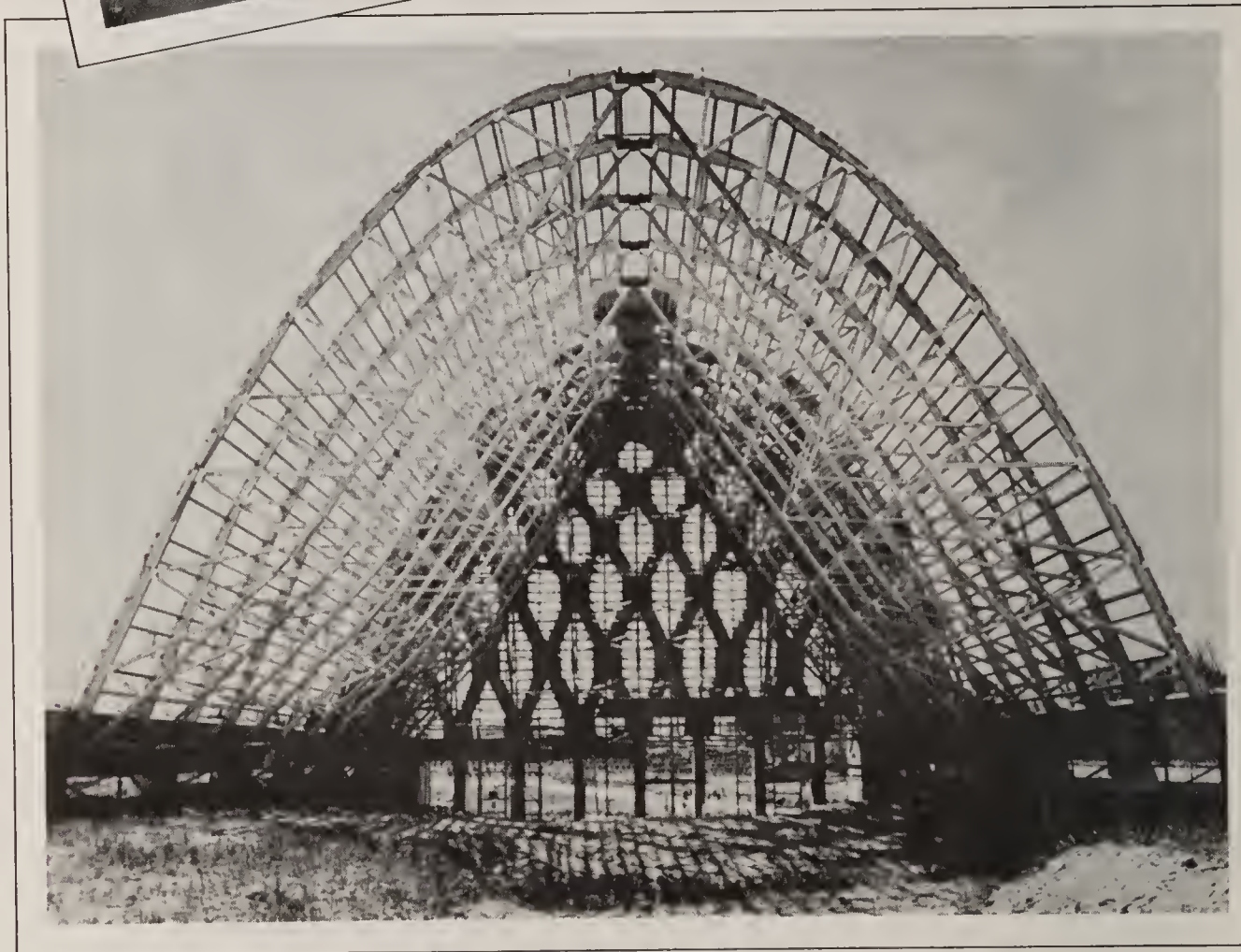
cal Gardens are the only such gardens between St. Louis and Los Angeles.

Dr. Hildreth retired in June as superintendent of the U. S. Department of Agriculture horticulture field station in Cheyenne.

The entire 18-acre plot south of E. 11th Ave. and York St. which extends east from Cheesman Park to Congress Park will be devoted to herbaceous plants.

Herbaceous plants are ones that are not woody—the annual and perennial plants that die in winter.

*Planting began outside on
a very modest scale*



*And then the conservatory
started to go up*

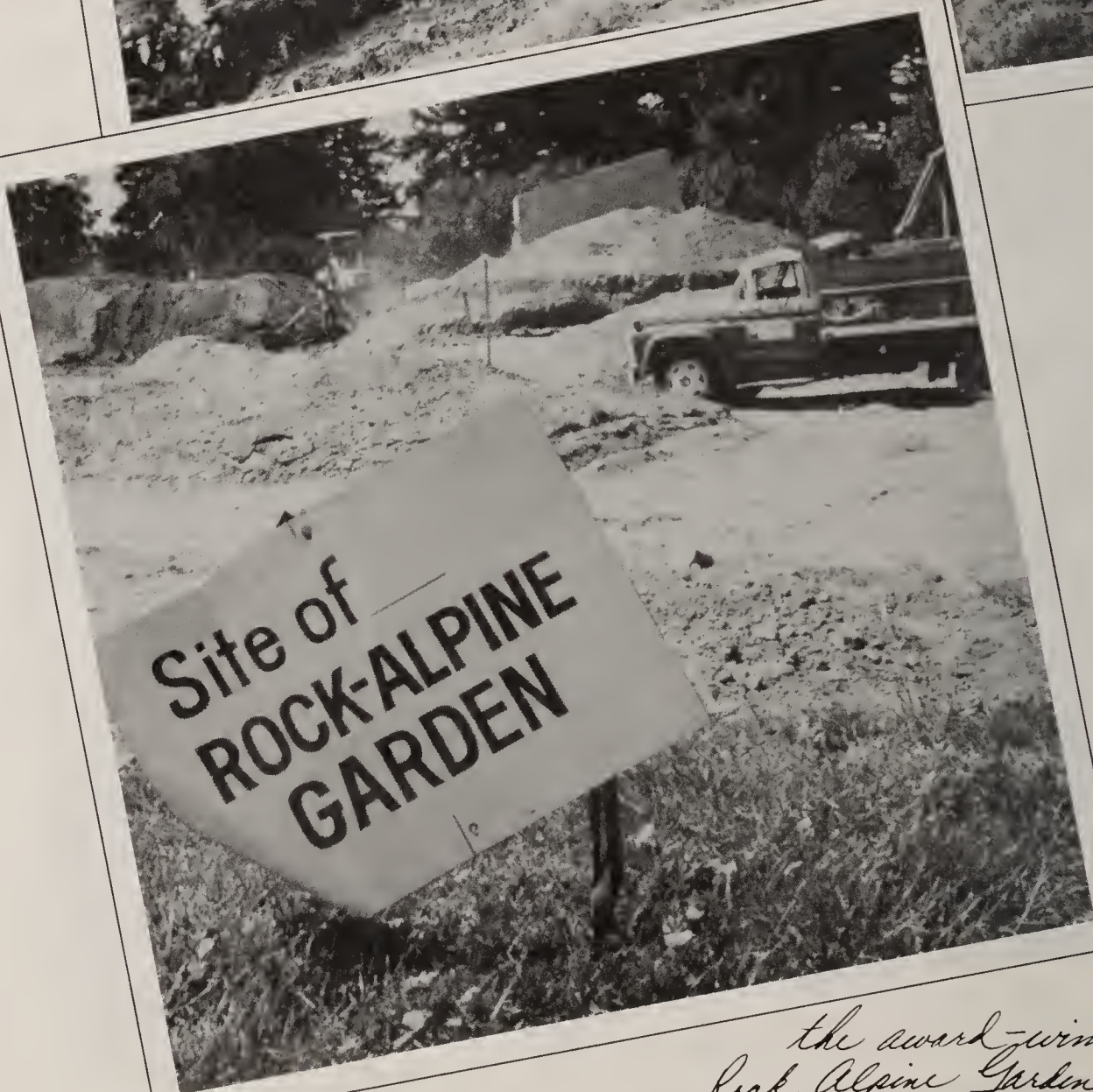


*the Gardens became a
beehive of activity*



which today looks like this

Garden



*planting the first Memorial
Rose garden*



*An early plant sale
helping the gardens to grow*



*inside the Conservatory
just after it was finished*

EXOTICS OF COLORADO

Some Exotic Trees at Denver Botanic Gardens

by Helen Marsh Zeiner

With the exception of the old established trees around Botanic Gardens House, 25 years ago the grounds of Denver Botanic Gardens were relatively bare of trees. The many trees that have been planted since help make the Gardens beautiful and give welcome shade for visitors, while also providing a way to test exotic new species and cultivars. Denver Botanic Gardens is now a place to see and enjoy unusual varieties of trees. You will find them well-labeled with both a common name and the correct botanical name.

Have you ever seen a bald cypress, *Taxodium distichum* (L.) Rich.? On the north side of the education building you will find two of these trees growing next to the building. Four were planted in 1971; in 1974, two remained and have been growing very well since that time.

Bald Cypress

Bald cypress is generally thought of as a swamp tree, but it is also found on drier ground. In swampy areas it may be found growing in pure stands. On drier ground, bald cypress grows mixed with trees such as willow, red gum, green ash, soft maples, and elms. Its natural range is along the Atlantic coast from southern Delaware to southern Florida, westward along the Gulf of Mexico into Texas, and northward through Oklahoma and

Arkansas to southern Illinois and southwestern Indiana. It is usually associated with very wet or swampy soil.

Bald cypress trees grow to be very old; some are known to be a thousand years old. These very old trees are huge, becoming as much as 150 feet tall and 12 feet in diameter. More commonly they reach heights of 120 feet with diameters of 3-5 feet. The trunks of old trees growing in swamps become buttressed with shallow roots spreading out from the base. In swamps where water stands, cypress "knees" develop. These cone-like structures form on the submerged roots and rise a few inches to several feet above the surface of the mud or water in which the tree is growing. Cypress knees are composed of soft, spongy wood and thin spongy bark. They may serve to help anchor the tree, but it is generally believed that their main purpose is to bring air to the submerged roots.

Taxodium distichum is a valuable timber tree. The easily worked wood is durable in soil and is used in construction, for flooring, water tanks, ships, cross-ties, shingles, and other miscellaneous uses.

Bald cypress is a deciduous conifer—that is, it loses its needles in the fall. The only other deciduous conifers are the larches, *Larix*. The needles of *Taxodium* are ½ to ¾ inch long, light yellow-green, and feathery in appearance. They turn yellow or brown and then drop in autumn. The tree, planted as an ornamental for its feathery

foliage, is widely used throughout its natural range, but is also proving hardy in other areas.

The name *Taxodium* is from the Greek, alluding to the similarity of the foliage to that of *Taxus*, the yew. *Distichum* is also from the Greek and means twice or double ranked, referring to the two-ranked arrangement of the needles along the twigs.

Hardy Rubber Tree

A very unusual tree can be seen at Denver Botanic Gardens near the peony beds. This is the hardy rubber tree, *Eucommia ulmoides* Oliv., planted in 1979 and now a thriving tree. The name *Eucommia* is from the Greek and refers to the fact that the plant contains rubber. The species name, *ulmoides*, is given to this tree because it resembles an elm with ascending branches and elm-like leaves.

Eucommia contains rubber in all its parts, but particularly in the young growth and the bark. It was introduced from central China with the hope that it might become commercially important.



Bald Cypress Leaves— *Taxodium distichum*



Hardy Rubber Tree Leaves— *Eucommia ulmoides*

The rubber is of good quality, but it is difficult to extract and is not present in sufficient quantities to make commercial exploitation profitable, at least at the present time. *Eucommia* is hardy as far north as Massachusetts. It is interesting to note that this is the only rubber-producing tree hardy so far north. Although not successful as a source of rubber, *Eucommia* has proved to be a good ornamental. In China the bark is valued for medicinal use.

Most plant families are made up of several genera and many species, but *Eucommiaceae*, the *Eucommia* family, contains only the genus *Eucommia* which in turn contains only the species *Eucommia ulmoides*. This fact makes the hardy rubber tree a unique plant.

Russian Hawthorn

If you enjoy flowering trees, you should see the Russian hawthorn, *Crataegus ambigua* C. A. Mey. blooming in spring. This tree was planted in 1979 near the test roses, and is easy to find if you are on your way to the Japanese garden.

As its name indicates, this very lovely hawthorn comes from southeastern Russia. It is closely related to the better known *Crataegus monogyna* Jacq., the English hawthorn.

The young branchlets are more or less hairy, later becoming smooth and

purplish. The thorns, only about $\frac{3}{8}$ inch long, are few. The leaves make the tree attractive even when it is not in bloom. They may be as much as $2\frac{1}{2}$ inches long, and are deeply and narrowly three-lobed, the lobes with a few sharp apical teeth.

When in full bloom this tree is a delight. The white flowers with red anthers, borne in profusion, are about $\frac{5}{8}$ inch in diameter. It is a small tree certainly worth consideration for use in your own garden.

Other Exotic Trees

As you stroll through Denver Botanic Gardens, you will find other "different" trees. Look for Turkish filbert, *Corylus colurna* L., with its regular pyramidal head and handsome leaves; upright linden, *Tilia platyphyllos* Scop. var. *pyramidalis* Kirchn., desirable for its narrow pyramidal habit of growth; eastern redbud, *Cercis canadensis* L., covered in early spring with pink pea-like flowers; golden rain tree, *Koelreuteria paniculata* Laxm., a small tree with

attractive compound leaves, large sprays of small yellow flowers (the golden rain), and interesting pods; Bradford pear, *Pyrus calleryana* Decne. cv. 'Bradford', grown for its early-blooming white flowers and its bright fall color; and star magnolia, *Magnolia stellata* Maxim., and saucer magnolia, *Magnolia soulangeana* Soul. whose large flowers are to be seen and enjoyed in early spring.

These are but a sampling of the interesting trees, planted within the last 25 years, to be seen at Denver Botanic Gardens. Walk through the gardens and you may find others equally interesting and worthy of your attention. ♀

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The Aubry Prints — Early Botanical Photographs

by Patricia Pachuta

As a part of *Fête des Fleurs*, Denver Botanic Gardens' 25th anniversary celebration at its present York Street site, twenty early botanical photographs are on display through September in John C. Mitchell II Hall. The work of Charles Aubry, the photographs were made in Paris during the 1860s and are thought to have been acquired by the present owners, Tiffany & Co. of New

York, during the French Revolution when some of the French Court jewels were bought by Tiffany's diamond buyers. Tiffany's chief silverware designer, Edward C. Moore, had an extensive art library at this time and may have purchased the photographs for design studies by his silversmiths. This type of industrial photography was the main thrust of Aubry's work.

With his camera, Aubry sought to provide decorative artists with models upon which they could draw when painting porcelain or canvas studies. Quotes from him indicate that he had a

Patricia Pachuta, education director at Denver Botanic Gardens, has been instrumental in bringing several notable art exhibits to the Gardens.



serious interest in increasing worker productivity in the industrial arts. This, he felt, was hampered by the lack of adequate portfolios from the design schools. It is believed that Aubry attended L'Ecole Libre de Dessign, established in 1765, and commonly called "the Little School" by its students.

It is unfortunate that so little is known of Aubry today except that he made several albums of floral studies, some of which were owned by Napoleon III. An imprint that appears on some of his photographs indicates that he was awarded a gold medal in 1864 but from whom it was received remains a mystery.

Originally intended to provide a modest source of reference material for decorative painting, Aubry's botanical photographs are noteworthy for their outstanding simplicity. His work was an important departure in taste and style from the conventional approach common in the early days of photography. Aubry's still lifes give the impression that the flowers are not cut but are still growing; this fresh approach, the hallmark of Aubry's work, came to be known as "artificial innocence."

A startling, dynamic quality also distinguishes Aubry's studies of leaves and fruit from the work of other early



photographers. The spirited images of his rich bouquets can be appreciated for a depth and dimension that far exceeded his contemporaries. Today, his methods of handling composition and technique are considered a precursor of the abstractions of the Art Nouveau period, common in the 1930s.

The permanent photograph collections of both the Metropolitan Museum of Art in New York and the Philadelphia Museum of Art contain works by Charles Aubry. The twenty photographs exhibited in John C. Mitchell II Hall were recently restored in Paris by Tiffany & Co. Denver Botanic Gardens gratefully acknowledges their generous support that made this showing possible. ☼



The Greening of Shofu-en: Japanese Garden in the Shadow of the Rockies

by William G. Gambill, Jr.

On the 23rd of June 1984 the Denver Botanic Gardens reached the fifth anniversary of the dedication of its delightful Japanese Garden, Shofu-en. Actual construction was started six years ago, and dedication was held very early so as to be a part of the "Japan Today" cultural celebration held around the United States in 1979. In what was regarded early on as a quite inhospitable location, there has come into being a lovely green glade where a harmonious blending of rock, plants and water engenders the feeling of tranquillity and a special closeness to nature. That this should happen in such a relatively short interval of time seems remarkable, especially to those who remember well the origins of this garden.

The dedication seemed at the time a none too auspicious occasion. Mayor McNichols and other City officials, the Board of Trustees, numerous well-wishers from the Japanese community in the Denver area, generous members and friends of the Botanic Gardens and the staff gathered to dedicate this first authentic Japanese Garden in the Rocky Mountain region. Those who were present will remember that the dedication ceremonies were only well under way at a unique Shinto altar

set up in the shelter of the Cheesman Park gatehouse when the heavens opened releasing torrents of rain, dampening very considerably the apparel of the crowd but, fortunately, not their spirits. Since there was very little in place in the garden by way of ground-cover except many cubic yards of wood chips, rivulets and streams of water soon began washing the clay soil and wood chips off the slopes, carrying a fair amount of both into the newly completed pond and depositing layers of mud and pools of dirty water where the walkways had not been completed, while swamping those walks which were in place.

Amidst the dampness and gloom one especially bright note was sounded by the imperturbable Shinto priest who came from San Francisco to help bless the occasion. He opined quite emphatically that this baptismal downpour was really a most favorable omen for the future of the garden. At the time one wondered whether, in his damp vestments, he was considering only the obvious need for plenty of moisture to promote the successful growth of plants in this desert area. Regardless of how one is inclined toward omens, a visit to Shofu-en will provide ample proof that many wonderful things have happened there in the past five years.

Today the garden is essentially complete. Trees, shrubs and ground-covers planted in abundance before and since the dedication are thriving. The raw newness of a very

William G. Gambill, Jr., Ph.D., Director Emeritus of Denver Botanic Gardens, secured the services of Koichi Kowana, designer of the Japanese Garden during his directorship at the Gardens.

young garden is disappearing under a lush green mantle of vegetation. A detailed consideration of the kinds of plants which have been involved in this greening of Shofu-en seems appropriate at this time. Most of them are not native here but introduced from other parts of North America as well as from Europe, Africa, Asia and especially the Orient. In their native haunts many of them are accustomed to more precipitation than is received in the Denver area. Here their needs must be maintained in the growing season through irrigation. With

sufficient water Shofu-en will be as green as its counterparts in Japan. The plants here are for the most part not the same as those seen in gardens in Japan. Japanese gardens in America are not intended to be replicas of those in Japan, but they do incorporate the design, the handling of materials and, above all, the spirit of the Japanese garden. The sense and spirit of Japanese design are, therefore, applied to the materials of the garden which are available to be used here and to the limitations imposed by the environment. (Engel, 1959: 4.)



Ground-covers in Shofu-en

Encouraging the use of mosses, or expecting them to appear naturally as they do in gardens in Japan, were not options which could be followed in Colorado. However, finding plants which would grow satisfactorily as ground-covers here was not as difficult as once feared. The very adaptable and now highly visible periwinkle or myrtle (*Vinca minor* L., dogbane family) with its trailing habit of growth and rich, dark evergreen leaves now covers sizable sections of the garden floor both in shade and full sun. The common blue-flowered form and the spectacular white-flowered variety were both planted. They flower heavily in spring but bear some flowers throughout the growing season. These plants provide greenness all year long, with new leaves appearing to replace the old ones in spring. Periwinkle is native in Europe, is widely planted in the United States where it frequently escapes cultivation and grows wild as a naturalized plant.

Another low-growing, stoloniferous plant forming part of the ground-cover is bugle weed (*Ajuga reptans* L., mint family). Leaves are much larger than those of periwinkle and may be dark green or copper-colored in hue. The bright blue or white two-lipped flowers are borne on upright spikes a few inches high and appear in spring, making a colorful display for a few weeks. This plant is also a native of Europe. They are to be seen between the west or flagstone walk and the Cheesman Park fence not far inside the main gate of Shofu-en.

Several species and cultivars of thymes (*Thymus* spp., mint family) provide fascinating ground covers in this garden. These plants are tiny aromatic subshrubs or perennial herbs with a prostrate or creeping habit of growth which range from ½-2 inches in height with very small leaves no more than ¼ inch in length.

India-strawberry or mock-strawberry (*Duchesnea indica* (Andr.) Focke, rose family) is often described as a "running perennial" growing prostrate and producing long runners and flowers

which much resemble those of strawberry except that the petals are yellow, instead of white. The compound leaves with three leaflets are also reminiscent of the wild strawberry. The fruit is small, red and quite resembles a strawberry, too, but is dry, tasteless and inedible though not poisonous. This plant is a native of southern Asia and has become naturalized in eastern United States.

An interesting, small mat-forming perennial named *Mazus reptans* N.E. Br. of the figwort family covers bare ground very quickly in our climate. It is no more than 2 inches high, roots quickly at the nodes, has coarsely toothed inch-long leaves, and bears attractive, purple-blue flowers about ¾ inch long—relatively large for so small a plant—and penstemon-like in appearance. A native of the Himalayas, it does well in both the Rock Alpine Garden and the Japanese Garden.

On the slopes and along the walks in numerous places in the garden a mixture of lawn grasses was put in position as sod and has given rise to a thick, healthy cover of grass. There is a sound precedent for using grass as a ground-cover for this is done quite commonly in gardens in Japan. Obviously grass requires a good deal of water, but it has contributed immeasurably to the greening of Shofu-en.

One of the few broad-leaf evergreen plants native to Colorado, the Oregon- or holly-grape (*Mahonia repens* (Lindl.) G. Don, barberry family) is used on a restricted basis in Shofu-en as a ground-cover. It is a low-growing shrub 10-12 inches in height with leaves which are renewed at the end of winter and become brightly-colored in fall and winter. The clusters of small yellow flowers open in late winter and early spring and continue for several weeks, followed by blue-gray, edible berries.

Moneywort (*Lysimachia nummularia* L., primrose family) is an attractive ground-cover for moist soil. It grows on the wet slopes of the stream in Shofu-en, and perhaps in other places. With



creeping stems and opposite rounded leaves about an inch long, this plant blooms throughout the summer with bright yellow flowers nearly an inch wide, the petals bearing dark spots. It is a native of Europe, but grows without cultivation in eastern and midwestern United States.

Two members of the iris family are very attractive residents of Shofu-en. The Japanese iris (*Iris ensata* Thunb.) grows along the banks of the pond and in the stream bed, flowering in early summer in handsome shades of blue, purple and white. A native of Japan, Korea and central China, it is one of the relatively few herbaceous flowering plants one will see in gardens in Japan. A tall, yellow-flowered water-iris (*Iris pseudacorus* L.) has become established at the foot of the waterfall and in the stream bed below. A native of Europe, North Africa and western Asia, in the United States it easily escapes cultivation and has become naturalized in wet places in various parts of the country. It can become weedy, so must be kept under control.

A sizable colony of narrow-leaved cattail (*Typha angustifolia* L., cattail

family) has become established near the west bank of the pond. This is an attractive plant but is not found in gardens in Japan. As it spreads rapidly measures may have to be taken to keep it in check. It is a native in the northern hemisphere in North America, Europe and Asia.

Another plant which is being tried on an experimental basis on the moist banks of the stream near the low bridge is pearlwort (*Sagina subulata* (Swartz) K. Presl, pink family). It is a low-growing, densely tufted evergreen perennial forming mats quite moss-like in appearance and bears tiny white flowers. If successful, it may become another important ground-cover plant in the Japanese garden here.

Needle-leaved Trees

Shofu-en, Garden of Pine Wind, is a name which is particularly appropriate because this garden has along its western border a magnificent backdrop of tall needle-leaved trees in adjacent Cheesman Park. That not all of these trees are truly pines is immaterial. There are large Austrian pines (*Pinus nigra* Arnold) from Europe and ponderosa pines



(*Pinus ponderosa* Laws.) from the Rocky Mountains. Present also are Colorado blue spruce (*Picea pungens* Engelm., pine family) which may have either silvery-blue or dull green needles and Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) also native to Colorado. These trees constitute a powerful evergreen presence and contribute much to the Japanese atmosphere of the garden.

Greenness throughout the year, but particularly during the winter months, is a traditional aspect of great significance to Japanese gardens. Concerning pines, Shofu-en architect Koichi Kawana states (1977:34) that in Japanese Gardens "the pine is a major basic structural tree. Traditionally it is called *tokiwa*, and as an evergreen expresses both longevity and happiness." According to Kawana (Ibid.) "The black and red pines symbolize the positive and negative forces of the universe. The Japanese black or male pine called *omatsu* represents the former [positive] force and the red or female pine called *nematsu* represents the latter [negative] force." The fact that Americans do not subscribe to these particular tenets does not really lessen

the meaningfulness of pines in Japanese gardens here. Pines, especially ponderosa pine, are the obvious "backbone" of Shofu-en. Japanese black pine (*Pinus thunbergiana* Franco) is being tried here, but does not thrive. Japanese red pine (*P. densiflora* Siebold & Zucc.) and a dwarf form known as Japanese umbrella pine, (*P. densiflora* var. *umbraculifera*) have also been planted.

Still other pines which have been set out are pinyon pine (*P. edulis* Engelm.) and limber pine (*P. flexilis* James), natives of Colorado and the Rocky Mountain West; mugo pine (*P. mugo* Turra.) and Austrian pine, natives of Europe; and eastern white pine (*P. strobus* L.) from eastern United States. Most noticeable are the "character" ponderosa pines, around 125 in number, collected in the Colorado mountains and contributed by the men of the Japanese community of Denver. The interesting T-shaped supports for the character pines, made of large pine branches with the bark retained, have both functional and esthetic aspects, and are a characteristic feature of gardens in Japan which have trees which need props to maintain their interesting habits of



growth. Several medium-size trees of Scotch pine (*P. sylvestris* L.), native of Europe, had been planted at the site before the time of Shofu-en. They are noticeable for their red bark. Other needle-leaved trees in Shofu-en include the white fir (*Abies concolor* (Gord.) Lindl. ex Hildebr.), Colorado blue spruce (*Picea pungens*) and *P. pungens* 'Glauca' which are native in Colorado.

Needle-leaved Shrubs

Planted extensively in Shofu-en and adding greatly to the greenness of the garden are cultivars of *Juniperus chinensis* L. of eastern Asia: 'Blaauw', 'Green Mound' and 'Nana', and cultivars of *J. sabina* L. of Europe and western Asia: 'Blue Danube', 'Buffalo' and 'Tamariscifolia'.

Broad-leaved Shrubs

Broad-leaved evergreen shrubs are important components of gardens in Japan, but it is almost impossible to grow them in Colorado. *Mahonia repens*, native here, has already been described under ground-covers. Dwarf Oregon-grape (*Mahonia aquifolium* (Pursh) Nutt. 'Compactum'), a cultivar from a native

shrub of the Pacific Northwest, has been planted in Shofu-en. Taller than *M. repens*, it grows fairly well here, but its evergreen leaves usually turn brown before the winter is over.

Deciduous Trees

Deciduous trees and shrubs in Japanese gardens are important in that they form an element which is in strong contrast with the evergreens at all seasons of the year. They are thought of as emphasizing the rhythm of the changing seasons, and they symbolize the transient and changing aspects of life. Most of the species which grow in gardens in Japan, but particularly the true Japanese maples (*Acer palmatum* Thunb.) and some of the ornamental cherries grow very poorly in the Denver area, if at all. Other species which are better adapted to the growing conditions here can take the places of the Japanese trees very successfully in showing the deciduous habit.

On the site where Shofu-en was built there remained from earlier plantings several trees of cutleaf weeping birch (*Betula pendula* Roth var. *gracilis*, hazel family). These were left in place by



the architect. With their white bark and graceful forms and their light green leaves which turn a beautiful gold in autumn, they add a delightful aspect to the garden. Other maples planted in Shofu-en which will be attractive and help bring the aspect of maples one associates with gardens in Japan are: Amur maple (*Acer ginnala* Maxim., maple family) from northern China and Japan, a large shrub or small tree with brilliantly red leaves in autumn; Tatarian maple (*A. tataricum* L.) from southeastern Europe and western Asia; Norway maple (*A. platanoides* L.) a large tree from Europe and western Asia; red maple (*A. rubrum* L.) from eastern United States, with clusters of bright red flowers in spring before the leaves, and red leaves in autumn; full-moon maple (*A. japonicum* Thunb. 'Aconitifolium'), Japan; trident maple (*A. buergerianum* Miq.) from China; paperbark maple (*A. griseum* (Franch.) Pax.); vine maple (*A. circinatum* Pursh) northern California to the Pacific Northwest; and *A. semenovii* Reg. and Head from Asia.

Several specimens of eastern redbud (*Cercis canadensis* L., pea family) now add their special touch of orchid-pink

color in spring before their leaves emerge; these trees are native in eastern North America. Several species of *Crataegus* (rose family), known commonly as hawthorn, thorn-apple or thorn, with attractive white flowers, red fruits and red or yellow leaf color in the fall have been placed in Shofu-en: *C. ambigua* C. A. Mey. from southeast Russia; round-leaved hawthorn (*C. chrysocarpa* Ashe.), cockspur hawthorn (*C. crus-galli* L.), and *C. viridis* L. 'Winter King' from North America north of Mexico.

Russian Olive (*Elaeagnus angustifolia* L., oleaster family) from southeast Europe and western and central Asia adds the silvery gray-green of its foliage to the garden. One specimen of the unique ginkgo or maiden-hair tree (*Ginkgo biloba* L., ginkgo family) is growing satisfactorily, although this ancient relative of the pines with broad leaves, known also as the "fossil tree", grows with difficulty in this area. For a long time it was known only in cultivation from the temple grounds in China and Japan, but a natural stand was discovered in China recently. Two hybrid magnolias are now growing in the



garden: *Magnolia X Loebneri* Kache (magnolia family) with parental forms both native in Japan and *Magnolia X 'Betty'*. Magnolias are present in many gardens in Japan.

Several kinds of crabapple trees have been planted in Shofu-en. One of the more spectacular, with double flowers which look like small roses, is Bechtel's Crab (*Malus ionensis* (A. Wood) Britt. 'Plena', rose family) which, unfortunately, is especially subject to the bacterial disease, fireblight. Most of the crab-apples are derivatives of *M. baccata* (L.) Borkh., the Siberian crab from eastern Asia, or of *M. floribunda* Siebold ex VanHoutte, the showy crab apple from Japan and possibly a hybrid itself. Binomials for many of the cultivated forms are difficult to determine, or the history of their development is not known. Cultivars of crab apples in this garden are 'Red Jade', 'Radiant' and 'Oekonomierat Echtermeyer'.

Cherries and plums (*Prunus*) and their relatives (rose family) planted here are: cherry plum or Myrobalan plum (*P. cerasifera* J. H. Ehrh.) native to the Balkans and central Asia; Japanese flowering cherry (*P. serrulata* Lindl. 'Kwanzan') with large, double

rose-pink flowers from eastern Asia; flowering almond (*P. glandulosa* Thunb.), shrub from Japan; Nanking Cherry or Winter Plum (*P. tomentosa* Thunb.), compact shrub with white flowers native in temperate east Asia; flowering almond (*P. triloba* Lindl.), shrub from China, the most commonly cultivated form being a double-flowered pink one; purple-leaf sand cherry (*P. X cistena* N. E. Hansen), probably eastern Asia, but exact origin unknown; and Japanese flowering cherry (*P. yedoensis* Matsum.), a fast growing, profusely blooming tree with single pink flowers becoming white with age. The most widely cultivated ornamental cherry in Japan and probably a hybrid in origin, this is the single-flowered cherry of the Tidal Basin in Washington, D. C. Specimens of Bradford pear (*Pyrus calleryana* Decne.) have been planted along the north fence in Shofu-en. A handsome ornamental tree from China with clusters of large white flowers in spring and mahogany-colored leaves in autumn, it produces very small non-edible fruits or none at all, and is resistant to fireblight disease.

Niobe willow trees (*Salix X blanda*



Anderss., willow family), a hybrid of two European and Asiatic species, have been planted by the drum bridge at the south end of the garden and near the small bridge in the north end. Their weeping habit of growth is very effective ornamentally in the Japanese Garden. Recently an American linden (*Tilia americana*, linden family) has been planted just inside the main gate near the stream. Two kinds of trees from the elm family have been planted in the garden. Chinese elm (*Ulmus parvifolia* Jacq.) is native in China and Japan. This is not the tree known so commonly in Colorado as "Chinese elm," which is really Siberian elm (*Ulmus pumila* L.), flowering and fruiting in spring. The true Chinese elm bears its flowers and fruits in autumn, and has a somewhat smaller and less coarse leaf. Zelkova (*Zelkova serrata* (Thunb.) Mak.) is a large tree native to Japan, with leaves somewhat resembling those of elms. The multitrunked specimen in Shofu-en is located along the north fence where it has been growing for several years. This tree has been tried in Denver before but with poor results. A specimen of hop-tree (*Ptelea*

trifoliata L., rue family), a small tree native in eastern and southern United States, with compound leaves of three leaflets, has been planted along the Cheesman Park fence.

Deciduous Shrubs

Twenty different genera are represented in the shrubs which have been planted in Shofu-en. The largest number belong to the rose family. Three specimens of service-berry (*Amelanchier* spp.), are best known for their early, showy white flowers coming out before the leaves. A dozen specimens of flowering or Japanese quince, *Chaenomeles japonica* (Thunb.) Lindl. ex Spach, and *C. speciosa* (Sweet) Nakai 'Orange King', are natives of Japan. *Cotoneaster* is represented by two species, both natives of China, *C. acutifolius* Turcz. and *C. apiculatus* Rehd. & E. H. Wils., which have tiny pink flowers, with the fruits on the former being black, and on the latter, scarlet. *C. acutifolius* was planted early to provide a hedge around the front side of the Teahouse. *C. apiculatus* is used more as specimen plants, scattered through the garden. Berries of both species are attractive to birds. Ninebark, *Physocarpus*

intermedius (Rydb.) Schneid. var. *parvifolius*, Rehd., is a spiraea-like shrub with bark peeling in thin strips, pinkish-white flowers in summer, and dry, inflated fruits. Native in Colorado and other parts of the United States, there are a half dozen specimens in Shofu-en.

Shrubby cinquefoil or five-finger (*Pentaphylloides floribunda* (Pursh) A. Love), long known as *Potentilla fruticosa* L., occurs around the world in the north temperate zone. It has compound leaves and attractive yellow, single flowers; a white-flowered form is among the many cultivars developed from this species. Both the yellow-flowered type and the cultivar 'Mr. Everest' with white flowers are growing in Shofu-en. The familiar shrub spiraea is represented by two dozen specimens of *Spiraea nipponica* Maxim. 'Snowmound', a native of Japan, with clusters of white flowers in spring.

Barberry, in the same family as *Mahonia*, is represented by two species in the Japanese Garden. Wintergreen barberry (*Berberis julianae* C. K. Schnied.), native of China, becomes a large shrub, with spiny yellow stems and branches, large leaves to 4 inches in length with spiny toothed margins and yellow blossoms in 15-20 flowered dangling clusters giving rise to black fruits with a white bloom. Fewer than a half dozen specimens have been planted. Japanese barberry (*Berberis thunbergii* DC.), a shorter shrub with dark red, spiny stems at maturity, leaves up to $\frac{3}{4}$ inch long with entire margins, yellow flowers reddish on the outside in clusters of 3-5, and red fruits is a native of Japan. About a dozen specimens have been planted. A purple-leaved form (*B. t.* var. *atropurpurea*), numbers about a dozen in various parts of the garden. Fruits of both species lasting well into winter are attractive to birds.

Two species from the genus *Cornus*, dogwood family, are to be found in the Japanese Garden. *C. alternifolia* L. f., the pagoda dogwood or green osier is

native in eastern and central United States and has small flowers in flat-topped clusters producing dark blue fruits; *C. kousa* Hance is a large shrub or small tree with flowers compacted into a dense head surrounded by four large, creamy-white petal-like bracts, and is native to Japan and Korea. Both species have been planted in the wisteria arbor.

Two shrubby forms from the composite family are growing in Shofu-en: Lavender-cotton (*Santolina chamaecyparissus* L.) is much-branched and evergreen, very aromatic, with silvery-gray leaves divided into very narrow segments and has yellow flowers in globular heads. It is a native of the Mediterranean region from Spain to Dalmatia and North Africa. About a dozen specimens have been planted close to large rocks. *Artemisia schmidtiana* Maxim. 'nana', mugwort or wormwood, native in Japan, is a dwarfed, tufted perennial only a few inches high, with much-divided silvery leaves; four specimens have been planted.

One of the most attractive shrubs in Shofu-en in autumn is the winged euonymus or spindle-tree, *Euonymus alatus* (Thunb.) Siebold 'Compactus', of the spindle-tree family. A native of Asia, it grows up to 4 feet high, with corky-winged stems and inch-long, elliptical leaves with finely toothed margins, which turn a flaming red in autumn accounting for another common name, burning bush. These shrubs have been planted on the slopes above the stream. In the Garden, also, are *E. europaeus* L., the European spindle-tree, native of Europe and western Asia, and its cultivar 'Aldenhamensis' with large, bright pink fruits and *E. nanus* Bieb. f. *turkestanicus* Dieck, a low, often procumbent shrub, native of western and southern Asia. Members of the genus *Euonymus* have their seeds surrounded by a brightly-colored fleshy envelope (aril), pink, orange, red to

lavender in their hues.

The olive family is represented here by two familiar groups of shrubs: forsythia (*Forsythia*) and lilac (*Syringa*). The golden bells of forsythia, native of China, appear in early spring before the leaves, on close to 20 specimens most of which are just inside the main gate. Most of these, 'Karl Sax', 'Lynwood Gold', and 'Primulina', are cultivars of the hybrid *F. X intermedia* Zab. Other cultivars are *F. viridissima* Lindl., 'Bronxensis', and 'Arnold Dwarf'. Most of the lilacs in the garden belong to a species native in China, *Syringa meyeri* C. K. Schneid., with light purple flowers in dense clusters. This is a small shrub, known commonly as Korean Lilac; more than two dozen are planted in various parts of the garden. *S. pekinensis* Rupr., native of China, with yellowish-white flowers, *S. vulgaris* L., the common lilac native of southern Europe, and *S. vulgaris* 'Katherine Havemeyer' also are present.

Two genera of the honeysuckle family, shrub honeysuckles (*Lonicera*) and the viburnums (*Viburnum*), are represented. The most abundant honeysuckle is *L. korolkowii* Stapf. var. *zabelii* (Rehd.) Rehd., a native of Turkestan, with rose or white flowers in late spring and bright red fruits. Native in Europe and Asia, several specimens of *L. xylosteum* L., the European fly-honeysuckle with yellowish-white flowers bloom in late spring followed by dark red fruits. Cultivars of Tatarian honeysuckle from Russia and Turkestan have been set out in the Japanese Garden: *L. tatarica* L. 'Bytown', *L. tatarica* 'Carlton', and *L. tatarica* 'Hacks Red'. Three to four specimens of each of these cultivars are in the garden, as well as three of *L. X bella* Zab. 'Dropmore'. The most abundant representative of the viburnums is the snowball bush, *Viburnum opulus* L. 'Sterile', with 11 specimens, a native of Europe, North Africa, and northern Asia, flowering in late spring and

early summer. *V. X carlcephalum* Hort. having fragrant white flowers with a little red has been planted, as has *V. glabratum* H.B. & K.

Representing the saxifrage family are two genera: Mock orange (*Philadelphus*) and currant (*Ribes*). *Philadelphus X virginialis* Rehd. 'Minnesota Snowflake' is a small shrub with double white flowers coming in early summer; the hybrid parents are uncertain. Two dozen specimens have been planted throughout the garden. The mock oranges are found in North America, Europe, and eastern Asia. About thirty plants of alpine or mountain currant (*Ribes alpinum* L.) were early planted throughout the Japanese Garden to start the process of greening. This is a dwarf form of the shrub which may grow no more than 3 or 4 feet high, and is native to the mountains of Europe.

Alder buckthorn (*Rhamnus frangula* L. var. *columnaris* 'Tallhedge', buckthorn family) is a slender shrub with a columnar habit of growth which is planted in several places in the garden to form a hedge along a sidewalk or against a boundary fence. A native of Europe, Asia and North Africa, it has obovate leaves and may reach a height of 12 feet. Flowers in umbels give rise to fruits which are red at first and then become black at maturity. It escapes cultivation in the eastern United States.

Wisteria vines have been planted at the base of the supporting poles of the wisteria arbor. Japanese wisteria plants (*Wisteria floribunda* (Willd.) DC.,) were received from Japan for this planting. One is now spreading across the roof beams above the arbor, and it is hoped that the top of the arbor will be completely covered in time with the vines. Intensely fragrant flowers in pendent clusters mark this as a member of the pea family.

Specimens of the tree peony (*Paeonia suffruticosa* Andr. 'White', buttercup family) have been planted in the Teahouse garden. These shrubby peonies

are native in the eastern Himalayas, Tibet and China and are particularly attractive. A specimen of *Rhododendron X ramapo*, heath family, has also been planted in the Teahouse garden. It is a native of China. Hanging over the fence at the rear of the Teahouse will be seen the arching branches of matrimony-vine, *Lycium halimifolium* Mill. of the nightshade family. This plant is a spreading shrub with spiny branches and clusters of small lilac-purple flowers native to southeastern Europe and western Asia. It was not planted in the Japanese Garden, but comes in from the garden of a neighbor.

Bird Life in Shofu-en

Not surprisingly the birds have found Shofu-en, enhancing its charm. A list of over 60 species sighted during the year in Denver Botanic Gardens has been compiled. More species are seen during the spring and fall migration periods than at other times during the year. The presence of water in Shofu-en is the main attraction for birds which can be seen enjoying the water at the waterfall, along the stream and at the pond. In spring several pairs of mallards spend a lot of time in the pond. Each year a number of clutches of eggs will hatch, and visitors are treated to the sight of small, furry ducklings paddling frantically to keep up with their parents. Unfortunately few reach maturity, for the hazards of neighborhood cats are impossible to eliminate. Pairs of Canada geese will spend a few weeks on the pond each year. Wood ducks and American coots are also sometimes seen on the pond. The belted kingfisher likes the pond; the great blue heron as well as the black-crowned heron have been sighted there, the attraction for these birds being the goldfish population, presumably. Daily one may see several species of birds drinking from the stream or pond including the robin, house finch, house sparrow, eastern blue jay, starling, grackle, red-winged blackbird, cowbird, magpie, mourning

dove, and crow. Flickers and downy woodpeckers may be seen working over the trees, year round. Barn swallows constantly fly over the pond hunting insects; violet-green swallows have been reported. Quite a number of warblers have been sighted particularly in the weeping birches and weeping willows. These include: myrtle warbler, yellow warbler, orange-crowned warbler, and yellow-rumped warbler. The rock wren seems to have adopted as a home the Japanese Garden and the adjacent Gates Garden. Both rufous-sided and olive-green towhees have been reported, as well as Swainson's thrush and the northern oriole. In winter numerous juncos, chickadees and pine siskins are seen, and not infrequently chipping sparrows and white-crowned sparrows. Kestrels have been sighted flying not too far overhead. One frequently hears the whirring of hummingbird wings in summer.

And not just birds enjoy Shofu-en. Turtles live in the pond, and young turtles were reported there this spring. For several seasons a large population of gold fish has inhabited the pond. Cottontail rabbits and earlier on an occasional jackrabbit have been spotted in the area near Shofu-en. The presence of wildlife in the midst of a great city cannot fail to bring joy to visitors; their ties with nature are strengthened. An important goal of a Japanese Garden is thus realized. ♀

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20th Anniversary Review — Associates of Denver Botanic Gardens

by Fran Morrison

Reaching for a star! A dream come true!

To many these are only cliches but to the founders of Denver Botanic Gardens and to the volunteers who struggled to provide funds necessary just to keep the doors open in 1964, the projected plans could have been an impossible dream.

Consider the 18 acres of mostly unlandscaped weed-filled plots, a staff of five people, a cadre of enthusiastic but unorganized volunteers—the prospect for a botanical garden did indeed seem like the impossible dream.

Every group activity owes its success to the inspiration and guidance that evokes the dream and provides opportunity for the formation of a workable organization. A list of those dedicated pioneers of our organization is a long one and certainly no review of the Associates would be complete without an acknowledgment of their contributions. Space limits individual mention but to report progress we must have a beginning. Director A. C. Hildreth and Joseph W. Oppe, assistant director, provided the motivation and

guidance for our beginning. The plant sale in 1964 was the catalyst.

For the first time plants were grown especially for the sale and were chosen from test trials at the Gardens and from plantings popular in Denver's parks. The Botanic Gardens Guild was responsible for sale of herbs and vegetables, members of the Colorado Federation of Garden Clubs solicited home garden donations, and Around the Seasons Club was responsible for ordering and selling all other plants. Volunteers came from everywhere.

Although a triumphant success, the sale was grossly understaffed. Dr. Hildreth and Mr. Oppe were continually pressured to lead tours of the outdoor gardens and with the opening of the Conservatory imminent, guides would be needed. An outlet for handcrafts and horticulturally related items, books and other educational materials was planned; the library and education committees were attempting to be of greater service; hostesses were needed to greet visitors at Botanic Gardens House.

On May 27, 1964, four members of Around the Seasons and four members of the Guild, both with limited memberships, met. They discussed ways to coalesce the two existing service groups and the unaffiliated volunteers into a workable organization for assisting Denver Botanic Gardens in physical and financial endeavors. Their ideas and proposals were submitted to Dr. Hildreth and, with his additions, later to the Board of Trustees for approval. Four months later, on September 23, a formal meeting

Fran Morrison, the founder of Associates, began her "career" as a dedicated volunteer at Denver Botanic Gardens when a miniature rose garden was planted on York Street in 1959. She served as president of the Associates and Around the Seasons Club, has been plant sale chairman or co-chairman a number of times. She is an integral member of the gift shop committee and works diligently with arts and crafts. A member of the Board of Trustees, she was named an Honorary Life Member of Denver Botanic Gardens in 1973.

was called for ratification of bylaws and election of officers—Associates of Denver Botanic Gardens was propelled from a dream into reality.

Because staff was minuscule and funds were lacking to hire professionals, proposed committees and activities approximated the Gardens' list of operations. In those early years the educational classes, lectures, library staffing, mailings, garden show, fund-raising, often plantings and plant maintenance were the work of volunteers. Many of these activities were initiated by or assisted by the Associates.

Not the least of the problems faced by the Gardens was creating public awareness of its facilities and programs. Many avenues offering information to the general public and enlisting its support and participation were proposed and implemented through radio and television, newspaper coverage, both regional and local, and brochures and printed handouts. A dedicated effort was made to train outdoor guides and prepare for the opening of the Conservatory in 1966; classes were scheduled in basic botany, houseplants and greenhouse plants; lecture series were begun. Tours for school children were an outstanding success and many garden clubs, civic

groups and individuals were introduced to the Gardens in this manner.

One of the delightful activities originated by our infant organization was the Christmas Tea for members of Denver Botanic Gardens to announce the opening of the gift shop and to welcome interested volunteers into membership in the Associates. The House was lavishly decorated, an 18-foot tree sparkled in holiday splendor and *The Twelve Days of Christmas* was the theme. Response and enthusiasm were so effusive that the House was opened to the public for the week. Thus the traditional Christmas decorating party was inaugurated; in the dining room our gift shop was formally launched with a sale of handmade tree decorations and handcrafted items as well as books, pamphlets and other educational materials. The annual Holiday Gift Sale is an extension of this event and remains a mainstay of our arts and crafts department. Potpourri and fragrance items, wreaths and candle-rings, ornaments from Christmas-past, bookmarks and "whimsicritters," swags and table pieces have brought distinction to the sale.

Our greatest financial contributions have been from gift shop profits. Although the Associates is not the chief



sponsor of the annual plant sale prospective members are informed that the one requested activity is assisting with the plant sale. As stated earlier, the plant sale was the primary impetus for formation of our organization.

Hostesses served at Botanic Gardens House until the Conservatory opened. Now the Information Desk, staffed entirely by volunteers, fulfills this vital role for the Gardens; it offers visitors a pleasant welcome, affords personal contact for those interested in the Gardens' programs and is a major source of new memberships.

The Conservatory guides unit was formed before the opening of the Conservatory. Training was and is provided both by staff and volunteers. An outdoor guides unit has now been reinstated and contributes immensely to the educational opportunities and enjoyable experiences found at the Gardens. Among those taking the tours are school children and young adults from public and private schools and from colleges in Colorado and neighboring states. Other groups include international scientists as well as outstanding national science winners, conventioners and tourists, garden clubs and civic organizations.

The maintenance committee has operated sporadically since our beginning and in recent years, with tight budget constraints, volunteers in the greenhouses and outside gardens have given thousands of hours of loving care while gaining valuable horticultural knowledge and enhancing the beauty of our facilities.

The hospitality committee faithfully provides refreshments for the annual luncheon, for the tree decorating party and for visiting delegations as requested by our director. A chairman keeps memberships in Associates current and the historian, for our amusement and amazement, maintains a picture and published article history. Via the news media the publicity chairman has acquainted volunteers with our educational programs, announced

holiday sales, autograph parties, various special events and accomplishments.

Hard work and enthusiasm have been the hallmark of our volunteers both present and past; their contributions have been vital to the dynamic growth of Denver Botanic Gardens. For the year ending September 1983 *reported* hours totaled 27,700 and for the 12 months past, 28,856 hours were recorded. A detailed summary of financial and physical assistance cannot be compressed into this 20-year review, neither is there a total compilation of hours donated; but a survey of our projected goals, finished projects and present responsibilities is overwhelming.

No report would be complete without giving credit and thanks for the encouragement and cooperation of our directors, the staff and the Board of Trustees. Our gift shop, first housed in a borrowed display case nestled in the entry at Botanic Gardens House, emerged into the oak-railed nook west of the doorways at Boettcher Memorial Center and finally into its present jewel-like setting.

Gift shop profits have bought such essentials as a truck, heavy duty tractor, deep well water system. Designated contributions financed greenhouse construction and additions, library acquisitions and furnishings, construction of Alpine House and funding for the curator of the Rock Alpine Garden, underwriting plans, projects and restorations at Chatfield Arboretum, donations to the general fund, endowment fund, a discretionary fund for the director and stipends for the student intern program.

An investment of faith and \$500 by the Board of Trustees in 1964 has grown into assets worth millions of hours expended in faithful volunteer assistance and more than a million dollars in financial contributions toward establishing an outstanding botanic gardens.

A stroll through Denver Botanic Gardens on this, our 20th Anniversary, will assure you that dreams *do* come true and you *can* aspire to catch a star. ✨



Volunteers are Vital



Two Decades of Christmas Designs at Denver Botanic Gardens

by Avalonne Kosanke

A time without the conservatory? Yes! This story begins when the Boettcher Memorial Conservatory was still a dream, and the house at 909 York Street, officially given by Mrs. James J. Waring in 1959, was the hub of all activity.

Having arrived in the Denver area in 1963, I was still a rank outsider, a brash newcomer, when in the fall of 1964 I was approached to lend my ideas for decorating the house for Mrs. Waring's Christmas Party. It was a chance too good to pass up. I had decorated many houses before, and if I failed to please now, well . . . But I couldn't. As I walked through the downstairs rooms, the possibilities seemed endless.

The theme chosen for joy (essential to the season), laughter (essential to the party), and traditional beauty (essential to me), was the Twelve Days of Christmas. A special volunteer workshop turned out great lengths of evergreen swags to grace the dining room windows and buffet, the wonderful spiral staircase, the archways of the main room,

the fireplace arched mirror, and other likely spots. These swags were caught with wide, moss green, satin bows, clusters of pine cones and sparked with fresh red apples. The stage was set for partygoers with an oversized partridge hovering over a very large pear in a quite leafless "pear tree" outside the entrance.

In the vestibule, a mobile of "Two Turtle Doves" greeted guests. Suspended from the arched hallway's light "Three French Hens" sent their shadows dancing across the scene. To enter the main room one had to step down two steps, and here the mobile of "Four Calling Birds" flew lightly above. A beckoning mobile of "Five Golden Rings" invited one to the far end of the room where the iron gates were flung wide in greeting. These carried matching panels of "Six Geese A-laying" and "Seven Swans A-swimming." Framed by the archway stood a ceiling-high Colorado blue spruce, studded with hundreds of wheat lights, elegant with 14 dozen fresh, fragrant white carnations in orchid pix. (These had to be changed throughout the season.) Here a happy host of "Maids A-milking", "Ladies Dancing", "Lords A-leaping", "Pipers Piping," and "Drummers Drumming" completed the theme.

It was during the creation of these figures that I began a 20-year appreciation for the many talents of Fran (Mrs. Graham) Morrison. Her rare humor

Avalonne Kosanke, charter member and former president of the Associates and a founder of the Gift Shop at Denver Botanic Gardens, has been in charge of the arts and crafts program since its inception. Her artistic talents are a highlight for visitors to the Lobby Court each Christmas holiday season. She frequently teaches classes in floral design for the Gardens.



and eye for comic reality meshed perfectly with the author's demand for perfection and attention to detail.

The figures had endless flexibility made possible by brass fasteners at each joint. Trims, laces, and dozens of different, brightly patterned papers gave each a personality. They elicited joy and laughter from the viewers.

Another year, with permission from Mrs. Waring, I broke from her favorite red-dominated color scheme, and let the house itself speak to me. In deference to its mood, inspired by the special blues and subdued gold tones dominating tapestries, stenciling, ceiling paintings, and the custom-woven rug of the main room, I choose a blue-gold color theme. As a newcomer to the region, I was enchanted by the shining spheres of salsify so common everywhere. There *had* to be a way to preserve and use them. I harvested hundreds. I experimented with hair sprays and paint and a dozen mixtures. I picked them full and opening and green. Most experiments failed. Their fragile parachutes loosed their moorings at the slightest touch. By mid-July I knew they must be gathered early in the morning, still tightly closed. Vacant lots provided plenty, and I choose the very largest. Once on my patio, their stems were strengthened, anchored, and the heads allowed to unfurl out of the wind. One by one they were glue sprayed, a messy job, at best, then glittered with

blue or gold. The stickiness gradually lessened, and, after several weeks, the stems were stubbed close to the head, taped, threaded to allow mobility, and a luxuriant bow of velvet roping added.

These same bows were added to the slender, tapering cones of white pine which had been dipped in a mixture of varnish and gold powder. These added both strength of form and a subtle richness which characterized the whole tree as well as the house itself.

The year of the opening of the initial portion of the present complex of Boettcher Memorial Conservatory, my imagination was soaring along with the diamond-shaped panels of the structure. Searching my mental storehouse of ideas, I recalled another of nature's flyaway wonders, the glistening white silk of showy milkweed. I remembered a technique used by my mother when I was a child. I needed plenty of large, unopened pods and large spools of strong linen thread—and plenty of time. Eventually hundreds of the silken balls hung from "the lines."

"The lines" must be explained. The length of our large family room is veed with a very strong cord, knotted every three inches. In each space between knots hangs one or more paper clips sprung to form a hook. When every hook holds a tree decoration, I know the Lobby Court Christmas tree will have enough.

My husband, Bob, is an integral part of



all my endeavors. That year he was called on to cut the dozens of red diamonds from window-weight plastic. This done, I flattened pairs of smaller balls of milkweed silk on opposite sides and edged the plastic in gold braid. He also spliced interlocking rings to form a "cage" for the larger silken balls. These were trimmed with a special, imported German braid and given a teardrop red jewel below. This red-gold-white color theme was completed with yards and yards of fresh cranberries strung by young volunteers while their parents and others assembled two truckloads of fresh greens, donated by the Denver Parks Department, into swags to decorate the lobby, garden wall, and the house.

One year, in my never-ending search for ideas, I came across large rolls of natural shaved wood from Sweden. Exploring its possibilities, I found it could be soaked and then formed around nails driven into a board. A gaggle of geometric shapes and a menagerie of animals later, Christmas angels, stars, and birds in many sizes took form. When dry these could be painted red or green to add variety. Another special "find" that year was a flock of hand carved, hand painted birds from Sweden. A perfect match! They perched saucily on burrs in shaving circles. To catch more light, the very-dried cranberry strings were rubbed with gold and draped in generous lengths

about the tree.

A search for new media is always in season. While touring Dallas, Texas, one year, I passed a fabric shop where a length of shimmering gold and multicolored fabric lured me inside. Its design was in perfect scale for a 5-inch tree. Don't ask the cost. Several yards tucked easily into my suitcase. Later they hung as a splendid challenge across the family room door. Still later, they emerged as glittering, star-topped trees. Then in search of something to complement them, I found an equally rich (and expensive) black-gold piece and a shimmering silver cloth with all the blues of our Colorado skies. At home, patterns came and went. Nothing jelled. Finally, butterflies in all shapes and sizes emerged. These required wings lifted to offset flatness. Bob designed an aluminum vee that could be hidden between upper and lower layers. Clips let them perch lightly on the branches. Various gold cords gave their wings lovely, three dimensional patterns. Eyelash tubing became exotic bodies. Such decorations called for a more sophisticated swagging, so gold chains were chosen. That was the year of fabulous fabrics! It was also the year someone donated the top from a giant Colorado blue spruce. It reached halfway across the lobby and elicited many expletives as the men leaned in to string



the lights and hang the decorations.

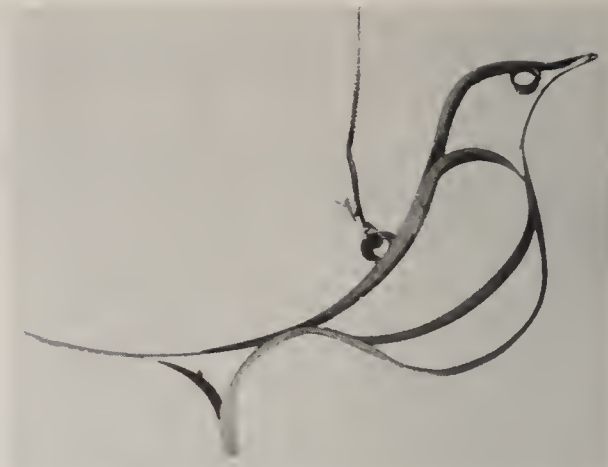
A swing in moods, and a return to salute yet another of nature's marvels. By then I was growing many species of alliums. Their forms varied in size and shape, from closely flowered drum shapes to exploding, starry balls. I searched my experiences of decorating against that vast expanse of gray lobby walls. Color was soaked up. Many times it disappeared. Always it was threatened unless reflective gold or white was used. Allium heads *au naturel* would never fly. Gold did little for enhancing their forms. White won out, so over and over they received another light coat. The paint also anchored the florets—and floated into everything surrounding the patio and on the patio, including the painter. When dry, the tedious task began. Each floret was red-jewelled. A generous splattering of rhinestones was added to catch and reflect the light. The balls varied in size from 4 to 15 inches. Tape strengthened the stem where a thread was inserted to allow the heads to spin freely in the air currents. It was a year when the decorating crew that came each year to help complete the picture had to work with special care. (Thankfully the swags and wreath-forms were now purchased, which eased the bedlam atmosphere of earlier years.) There was a subdued sheen to the heavy cable cord, and its whiteness provided the line of

contrast needed to control the circular forms.

In the year of roses, 1975, full 4-inch French silk roses in three luscious shades of pink, were protectively backed with metallic leaves, and each was tied with an old-rose velvet bow. Rich contrast came from the gross of jeweler's golden bangles framing pink seashell slices and topped by pink satin bows.

Next came the year of the peacock colors. Dozens of feather-eyes swung in rings of velvet roping. Blue-green checked, 3-inch ribbon was rubber cemented onto 4-inch white satin ribbon in a time-consuming process that nearly did some of the crew in from the fumes. This double ribbon was twisted lengthwise and wound about the tree to enhance the delicate foreground colors dominant in the two gross of hand-painted eggs. These eggs were among the first trade items purchased from newly opened China sources. Each was crowned with a jewel finding and protected by an oval gold ring tied with delicate two-toned satin.

A swing back to tradition ended in a foray into paper sculpture and a sharp new look for the Twelve Days of Christmas. Dozens of papers were tried. The best, bond typing paper, proved a winner. An entire ream was meticulously edge marked, then alternately scored on opposite sides. This permitted precise,



sharp folds. The stiff white forms came to life as they danced and cavorted around the twelve tiers of the white-rope tree, topped, of course, by a doting partridge and pear.

A western theme ached to be done. Early in the year we began wiring the wild-looking rope horses. Each was dipped in a stiffening solution but usually galloped off on its own. Next came cowgirls and cowboys, each replete with western hat, plaid shirt, tied neckerchief, lariat and gun in holster-belt. There was a fringed skirt of soft leather for her and heavy leather fringed chaps for him, thirty cuts per side, a hand-aching process. Real rope with numerous, wired-in loops circled the tree, and a rope-sign welcomed viewers.

The first year for membership Sunday was 1979, and the St. John's Cathedral choir was scheduled. They were to appear in red robes and sing from the balcony of the Conservatory where members would be seated in the pathways. Of course! A bevy of pony-tailed girls and tousle-headed boys, songbooks in hand, emerged from our worktable. Fine red velvets, corduroys, and eyelash fabrics were fashioned into suits, skirts, and flaring capes. These figures shared the scene with a snowstorm of quilled snowflakes sparkling with white glitter.

Lace was lavished on the elegant '80 tree. Thirty-five kinds added interest to the delicate, open look of the lace eggs. Red velvet stars, lace-edged, were added for contrast in form and color.

A need for laughter brought out the



clown in '81. Wild red hair topped hand-painted faces. Lace cuffs and ruffs set off their many-patterned suits. Toting over-sized drums or balloons aloft (Have you ever tried to spray paint a ping pong ball?), these glad-sad characters ambled into everyone's heart. Two life-sized clowns cheerfully dripped red paint and sloppily lettered a greeting at the fountain-head (I never did get back two pairs of tennis shoes!)

Designed for the future, in '82 a galaxy of stars and planets showered across the tree. The tall, narrow Douglas-fir lent itself to the shimmering black-gold-silver milky way woven into its depths. Hundrends of hand-wound balls, some with 35 yards of cording, donned planetary rings and mingled with twinkling mirror balls and gold-edged stars. It was definitely a crowd pleaser for the younger generation.

A southwest theme had never been tried. The summer of 1983 was spent winding Ojos de Dios (Eyes of God) in many sizes and color combinations. Minute red peppers were formed into wreaths and centered over tiny mirrors. Great ristras carried the theme throughout the lobby area.

And what will appear in '84? Who can tell? The theme is traditionally a carefully guarded secret unknown even to the decorating committee till they help unpack the boxes on the night of magic. But then, Christmas should always have a few delightful surprises. Let's hope it always does for visitors to the Denver Botanic Gardens.



Vegetable Gardening On Your Lanai

by Richard Hannigan

This is the time of year when a multitude of vegetable gardening articles appear in publications, most of them directed to the backyard gardener. There is little information available which is specifically written for the apartment, lanai, or small courtyard gardener. Many such people can find great enjoyment and relaxation in gardening on a small scale.

The primary requisite is to have good sunshine for at least a half-day, and preferably more. This means that a south facing location is best, but an east or west exposure will do. North facing locations are difficult spots for growing vegetables, yet such flowers as fibrous begonias, impatiens, lobelia, and a few others will do well.

Containers

Containers are an important consideration. The lanai gardener is usually faced with a shortage of space and

must find ways to make all available room useful. Highly recommended is the ordinary clay pot, usually in a 12 inch size, although the 10 inch will do. These are available locally and can be used year after year. Do not make the mistake of dumping out the soil in the fall so that you must refill containers the next spring. Soil saved in pots through the winter can be rejuvenated by the addition of some organic matter, such as peat moss, and used again.

Tubs, usually redwood, either square or octagonal, are also excellent if they are at least 12 inches across the top. Rectangular porch boxes are also good. Hanging baskets lend a gay note to your gardening and offer additional growing space but are more difficult to keep watered properly. The plastic baskets with the small saucer molded beneath are much more satisfactory than the old-fashioned moss-lined wire baskets.

Following graduation from "Colorado Aggies" (CSU) with a BS degree in horticulture and major in floriculture, Mr. Hannigan was employed in various capacities in the florist industry. He owned and operated Hannigan's Greenhouse in south Denver from 1957 until 1973.

When the Annual Plant Sale and Auction was expanded into a mini-version of its present format in 1964, he was asked to grow those annuals proven best in the test trials at the Gardens and at Denver parks. He enthusiastically provided colorful hanging baskets, "alpine" tomatoes, herbs, and patio plants as well. Over the years he grew thousands of plants for the Gardens.

Semi-retired and now living in Estes Park, he taught classes at DBG in house plants, vegetable gardening and patio gardening.

This reprint, published in Summer 1975, Vol 32 (2): 50-54, is typical of horticultural information furnished readers of *The Green Thumb* and commemorates the 40th Anniversary of the magazine. The subject is also in keeping with our current theme, small space gardening. When Mr. Hannigan was invited to update vegetable varieties recommended in his original article he found that new and better introductions of vegetables are few. His additional comments are enclosed in parenthesis.

A note of caution when you are arranging your lanai garden, particularly on the upper floors of an apartment house. Provision must be made to catch or direct excess drainage water so it will not drip on your neighbors below. Saucers are a great help and will also prevent stains if you have a concrete deck. Most apartments have a safety regulation concerning hanging planters outside the protective railings or setting pots upon these railings. It is perfectly all right to hang a pot or porch box inside the rail, making sure it is well fastened. A location near the top of the railing has the advantage of getting a great amount of sunlight.

Soil

After choosing the proper type of container for your use, you must provide and prepare the soil. As the commercial plastic bags of potting soil contain a great deal of finely ground peat and vermiculite, both of which tend to pack together and stay wet too long, a good mixture to use is one-half potting soil and one-half good garden soil. Mix the two together, adding a tablespoon of either bonemeal or phosphate to the amount needed to fill a 12 inch pot. The most practical place to obtain the garden soil is from a friend who has gardened in the backyard for some time. The amount you should need will not deplete the friend's garden and will help you. You can also obtain soil at a commercial greenhouse or garden center.

When filling containers, it is important to place a suitably sized rock over the drainage hole in pots and either rocks or small pieces of screen over the holes in the bottom of wooden boxes.

Plants

Most plants for lanai gardening are grown from seed sown directly in the containers. Exceptions are tomatoes and green peppers. When sowing seed, have the soil well pulverized on top of the container, spread the seed thinly, depending on what crop you are sowing, and cover it with a mixture of peat moss

and soil. The purpose of covering with this mixture is to help maintain a more uniform moisture condition until the seeds sprout. A general rule is to use enough soil to cover the seed with 4 times its diameter. An aid in keeping moisture in the soil until seeds germinate is to cover the container with a plastic wrap. Be sure to remove the plastic when germination has started.

Tomatoes and peppers, which you should grow from started plants, are best purchased at a local greenhouse or garden center. Do insist on getting the variety you desire. Most reputable firms will have everything well marked.

The crops with which you can expect to succeed are many. Your individual space considerations will determine the number and kind of plants. The following information should help you to make intelligent decisions for your lanai garden.

Lettuce is a favorite, and it grows quickly and easily. When ready to start eating, it will provide the succulent leaves over a fairly long period of time. Varieties usually available are Black Seeded Simpson and Grand Rapids. Do not buy head lettuce for you will usually be disappointed. A good thing about the



Cucumber



Tomato

lettuce family is that you can eat the outer leaves and the center will continue to grow. Four to 6 inches apart is the proper spacing for plants when you thin out the original seeding.

Another favorite is spinach. Spinach grows quickly and has a fine taste, whether eaten raw in a salad or cooked. Dixie Market is a suitable variety. Like lettuce, the outside leaves may be eaten while the plant continues growing. A good idea with these two vegetables is to make successive sowings about two weeks apart, starting in mid-April and again about May first. Space the plants about 4 inches apart.

Radishes grow very quickly, requiring about a month before harvest time. It is very easy to get too many radishes, so unless you are a devotee of the little hot roots, don't plant too many. Early Scarlet Globe is a fine variety. Space the plants at 2 inches. Many gardeners place their radishes in odd spaces with other plants since the radish takes little space.

If you select the newer small size carrots, you will do well with this vegetable. Burpee's sell a variety called Little Finger which produces fine 3 to 4 inch carrots. You can choose larger carrots such as Danvers or Chantenay and eat them before they grow to maturity. The young carrots do taste better. Spacing should be 2 to 3 inches for

good results. The foliage is attractive, perhaps the most attractive of all the vegetables. Plant in late April or early May, and be aware they are not quick to germinate, so give them time.

Onions are another rewarding vegetable and also lend themselves to being planted in odd places. The White Lisbon Bunching variety is a good one, growing readily from seed. Plant in early April, about one inch apart, or thin to that dimension. Onions can be pulled for eating almost anytime after they obtain sufficient size. Do not attempt the large globe type onions for their season is long.

Related plants are chives and garlic. Chives can be purchased in small pots already started. Plant them outdoors in summer and, when frost comes, cut them back and bring inside to grow in a sunny window for a garnish through the winter. Garlic can be grown from grocery garlic bulbs by separating the small cloves and planting among your other plants.

Almost all organic gardeners believe that garlic is a good insect repellent. Try it.

Undoubtedly, the most satisfying plant is the tomato, providing you choose a variety suited to lanai gardening and plant it where it will get a great amount of sunshine. The variety Patio, a dwarf, compact plant with a strong stem and good leaves, has been very successful. Fantastic is another good variety, which must be staked for best results. It is important that the tomato gets sufficient water, particularly when pot grown. Proper watering means applying a large enough quantity of water on a particular day to thoroughly wet the entire soil ball. THINK as you water; a pot which contains perhaps 12 quarts of soil will not get wet with only a few cups of water. When a pot is on the dry side, most of the first water you apply merely runs down the crack between the pot wall and the soil ball and out the bottom. The second dose of water will begin to soak into the soil, because, by then, the crack has swollen shut and water will penetrate. Keep applying water until you are satisfied that the entire pot is uniformly moistened.

When growing tomatoes, it is important to remove the small growths called suckers, which occur in the leaf axils. If you don't know, ask someone to show you. Other tomatoes which do well in lanai culture are the Red Cherry and the Yellow Pear, BUT ONLY if you limit the amount of growth by pruning off some shoots. Yellow Pear will grow in a hanging basket by limiting it to 3 stems which will hang down by the force of gravity as the stems get longer. The miniature variety, Tiny Tim, produces a good quantity of very small, marble sized fruit. Most people grow it as a novelty. By all means, buy started plants, preferably sturdy ones about 6 to 10 inches tall.

(Commercial seed producers are continually introducing new varieties, some good and some not so good. Ask at a reliable greenhouse outlet for recommendations of new varieties suitable for your purpose. Grow the proven ones for your principal crop but do try a few new ones for comparison. Also, read as many seed catalogs as you can get for they contain a wealth of excellent information.)

One or two green peppers can be fun to grow and since they are a long season plant, you should get them from a greenhouse or garden center. Yolo Wonder and California Wonder are varieties to look for. Hot peppers are usually available if they appeal to you. Pepper plants need a great amount of sun. When purchasing any plant, always look on the underside of the leaves to determine if green aphid or red spider is present. Just a few of these pesky insects on a plant when you buy can become a major annoyance in the garden later on.

The vine crops, such as cucumbers or squash, can be made to perform well in lanai gardening if provisions are made for a place to let the vines run. It is a good idea to grow these items vertically, such as up a netting attached to your railing, or possibly to a wall, if not too hot a location. Vines can be grown in large pots if an upright stake is first placed in the center of the pot. Ideally the stake should have several small cross-pieces to provide

a place to tie the vines. Old nylons make good ties, much better than thin string, and twistems are also good.

The summer varieties of squash, such as the Crooknecks, either White or Yellow, are the best ones to grow, but there are other varieties as well. Zucchini, while popular in the backyard, grows too large for most lanais. Usually three seeds planted in one place are best. Cucumbers can be treated in the same manner, and there are many good kinds, one being Marketeer. Burpee's offer good early maturing hybrids.

Beans and peas can be grown, but only if you have a larger space. An 8-foot row of beans will provide enough for one person, so you see, you need considerable space to feed three people. Peas take even more space to give a satisfactory harvest. Should you elect to try beans, buy the pole type, such as Kentucky Wonder or Blue Lake Pole Bean.

In addition to the previously mentioned vegetables, you can grow such items as beets, turnips, eggplant, and others. Your success will depend on your location and amount of time and space you can devote to your garden. Best advice is to stick to fewer plants and try to do a superior job with them for the most satisfying lanai garden.

A moderate application of a balanced fertilizer applied twice through the growing season will be satisfactory. Do not over-fertilize.

There are many good publications concerning gardening in general and one of the best sources of information is the Denver Botanic Gardens library. While it is necessary to be a member to check books out, it is money well spent to join this fine organization. Newspapers and magazines also provide some information, but keep in mind that lanai gardening is somewhat different from gardening on a bigger scale in the yard. Also remember that many books are geared to conditions in other parts of the country and the instructions must be modified for our Colorado climate and shorter season.

FOCUS ON JOJOBA, *Simmondsia chinensis*, IN THE BOETTCHER MEMORIAL CONSERVATORY

by Peg Hayward

Simmondsia chinensis (Link) Schneider, jojoba or goatnut, has been added to the Boettcher Memorial Conservatory collection. Jojoba is native to the dry foothills of California, Arizona and northern Mexico and grows at elevations from 1,000 to 5,000 feet.

The genus *Simmondsia* commemorates the 19th century English naturalist, J. S. Simmonds. Its species name *chinensis*, meaning of China, is misleading and was a mistake of an early botanist who thought this plant native to China. Jojoba is in the boxwood family, Buxaceae.

In the 1970s jojoba became the subject of intensive research, investigation and trial as a source of oil that has properties so similar to those of sperm whale oil that it can be used as a substitute for that increasingly scarce commodity.

Worldwide interest in jojoba as an economically viable agricultural crop is growing. Even in semiarid regions of western India, far away from its native origin, test programs have been initiated to determine how well this shrub will

perform.

Jojoba is a rigid, much branched, evergreen shrub 2 to 6 feet tall. Opposite, thick, bluish-green leaves are undivided and toothless. Male and female flowers, usually having greenish sepals and no petals, are on separate plants. Male flowers are somewhat cupped in shape with 10 to 12 yellowish-green stamens. The females are bell-shaped and have a prominent ovary and 3 styles. Female flowers are solitary, the males clustered. Fruits are acorn-like, three-angled, one-seeded capsules about $\frac{3}{4}$ inch long.

Jojoba flower buds appear in spring and summer and remain dormant until the following spring. Scarcely 30 percent of the buds develop into flowers and only half of these produce seed. Part of the failure of the fruit to set is due to the fact that maturation of female flowers and release of pollen by the male flowers are not synchronized resulting in incomplete pollination. Since the seed is the source of the liquid wax, studies have been made to develop procedures for simultaneous breaking of dormancy in male and female plants. The annual yield of seed per shrub is about 2 pounds.

Extraction of jojoba oil was started in 1977 using the Hander Press purchased from Japan. The double extraction procedure appears to be the best method of oil extraction with this press.

Jojoba oil can be used as a lubricant for high-speed machinery, as an additive to other lubricants, and as an ingredient of soaps, shampoos, face creams, hair oils,

Peg Hayward, a long-time member of the Associates of Denver Botanic Gardens, prepared much of the plant list information used in the first *Conservatory Plant Guide*, an issue of *The Green Thumb* (May-June 1966). She has been active in the conservatory tour guide training program from its beginning, and serves on both the editorial and education committees of the Gardens.



Jojoba, *Simmondsia chinensis*

as well as furniture polishes, floor waxes and automobile waxes. It may also be used for cooking.

Attempts have been made to introduce jojoba into cultivation as a new crop for the southwestern United States. Large scale cultivation of this plant is a possibility.



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Landscape Trees For Small Spaces

by Merel O. Woods

This discussion will be limited to trees with a mature height of about 30 feet or less under normal landscape situations. Many variables affect the size of trees. All are intended to be planted in open ground areas, not in planters.

With the trend toward smaller urban lots these smaller trees may be especially suited for the space available.

Consideration must be given to growth habit, whether spreading or very upright. When a tree is planted, room for growth is needed in all directions. In some cases trees may be clustered for a grouping or screening effect. In these situations height should be no problem, but sidewise growth needs special consideration. The plants can grow together some, but not to the extent they are too much competition for each other. Proper pruning can help keep trees at desired heights and widths, but the natural shape should be maintained wherever possible.

Most trees suggested are adapted species, some from the Rocky Mountain area and others from faraway places. In the Rocky Mountain region several life zones exist over very short distances due to variable elevations and exposures. A beginning point to consider in selecting woody plants for this area must be hardiness ratings or zones based on

average annual minimum temperatures. Ours at the eastern base of the mountains is -10° to -20° F. Other variables to keep in mind, which may be more critical than the hardiness zones, are winter sun, drought and desiccation, rapid daily temperature fluctuations and extremely variable spring and fall freezes. Indeed, the weather is like a yo-yo!

In addition, many soils are heavy clays with poor drainage (percolation by gravity through the soil) whereby water takes the place of much of the air as it moves slowly through the soil. Woody plants do not thrive in these soils. Knowing your soil can be the difference between success and failure. Soils are so mixed up after subdivisions are built that a front yard can be completely different from a back yard and have nothing in common with a neighbor's yard.

Digging down into the soil at least 8 inches in the root zone of established plants and feeling the soil for moisture can help determine watering intervals. If it feels moist, do not water. If it feels dry, do water. These intervals might be as far apart as every three to four weeks during the growing season. Monthly checks should be made the same way in winter in extended dry periods if the ground is not frozen. Many times just planting woody plants separate from bluegrass and watering only for their needs will be beneficial.

Some of our trees, such as crab apples and hawthorns, come from genetic groups with many species, varieties or cultivars. Others such as the goldenrain may have

Merel Woods, an arborist-horticulturist with Colorado State University Extension Service, was involved for several years in efforts to control Dutch Elm disease. Previous to his public career as an arborist, he was a nurseryman in the South Metro-Denver area.



Populus tremuloides *Malus* *Sorbus aucuparia* *Euonymus europaea*

only one species available for use. As these plants become better known and used, invariably, growers' interests are kindled and soon better cultivars are developed. These cultivars may offer different forms, better aesthetic qualities and even freedom from certain pests.

Decidious Trees

Aspen (*Populus tremuloides* Michx.)
Height 20' - 30'

Aspens have really exploded on the landscape scene in our area. Ultimately, as seeds are collected and propagules taken from better populations, their use should improve. They are quite pest-prone and care must be given to avoid injuries to their trunks making them vulnerable to many diseases. They spread easily by root suckers and are best in group or clump plantings. Even if they die at a height of 10 to 15 feet, new sprouts will come up quickly to perpetuate the effect. Aspens need rich, moist, but well-drained soils, never heavy clay. The desirability of aspens is in their gray to white turnks, small but constantly fluttering leaves and yellow to occasional orange fall color.

Crab Apples (*Malus* Mill. spp.)
Height 15' - 30'

Crab apples have magnificent blooms in spring with colors ranging from white to pinks and reds. Almost countless selections are available—spreading, upright, pendulous branching types and even real dwarfs of less than 10 feet. They make fine specimens for accent or the

patio, and are appealing in small group plantings. The foliage is attractive with variable autumn color; some have reddish-hued leaves during summer. The fruits are pink to red and even golden, and some make delicious jelly. For those who do not like the fruits, there are varieties that bear few fruits.

The use of crabapples must be tempered unless fireblight, a major disease, is understood. The best defense is a healthy growing tree where sanitation and proper pruning have not been neglected. Future selections should look to fireblight resistance.

Because there are so many choices available, consult a local nursery for a selection with the preferred characteristics.

European Bird Cherry or Mayday Tree (*Prunus padus* L.) Height 20'

This very hardy tree with clusters of small, white, fragrant flowers in drooping racemes up to 6 inches long blooms in April-May. Cultivars are available with variations in flower size and an earlier bloom in spring. Fruits develop as small black cherries in midsummer. The green foliage is attractive and the tree has an open growth habit. The European bird cherry would be excellent as a specimen or patio tree.

European Mountain Ash (*Sorbus aucuparia* L.) Height 20' - 25'

An excellent specimen tree, this mountain ash can be multi-stemmed or



Koelreuteria paniculata



Crataegus

single-stemmed taking on an oval-to-spherical, gracefully open head at maturity. It is popular for its flat, white flower clusters in May-June, pleasant open foliage with compound leaves, and fruit clusters of bright orange, berry-like pomes in late summer and early fall. It displays attractive reddish autumn leaf color. Birds usually get the fruit before winter. Fireblight is a major pest problem.

European spindle tree (*Euonymus europaeus* L.) Height 15'

This spindle tree is effective as a narrow, upright shrub or tree, which broadens with age. Flowers are not showy and the foliage is a dull dark green. Fall color varies from yellow to reddish-purple. Fruits are four-lobed, pinkish-red capsules which open to expose bright orange seeds. Leaves persist late in autumn and provide a background for the colorful fruits. The selections 'Aldenhamensis' and variety *intermedius* Gaudin fruit more heavily than the species. These are good small trees for groupings and screens.

Goldenrain Tree (*Koelreuteria paniculata* Laxm.) Height 25'

Beautiful, conspicuous yellow flower clusters about midsummer followed by attractive bladder-like pods characterize this tree. The showy pods are frequently tinged with red in autumn, and often hang on the tree into winter. A fine specimen or patio tree, it can be used in screens as well. It has few pests, is

drought resistant and tolerates a wide range of soils. Because of its fast growth, attention must be paid to proper training and pruning.

Hawthorns (*Crataegus* L. spp.)

Height 10' - 30'

Several species and varieties of hawthorns are hardy here. Most have flat clusters of white flowers in spring; a few have pinkish flowers. Fireblight can be a problem with some pink-blossomed selections. Some have exquisite glossy green foliage during the growing season and fall color is a bonus; many boast fine orange to red colors. Their miniature red pomes are often held well into winter. Winter patterns are interesting—some branch parallel, some have fluted and twisted bark. Thorns are long on some selections. Hawthorns make good patio or specimen plantings and are useful in groups or screens.

Japanese Tree Lilac (*Syringa reticulata* (Blume) Hara) Height 15' - 20'

The Japanese tree lilac may be grown with a single or multi-stemmed trunk and the shiny cherry-like bark is attractive in winter. Although it does not sucker, basal trunk sprouts may have to be pruned away occasionally. The flowers, small creamy-white blooms in 6-inch long pyramidal clusters, appear in mid-June. The tree with a rather open form has leaves larger than common lilac. Outstanding in a screen or windbreak, group planting, or even as a



Syringa reticulata



Acer ginnala



Prunus cerasifera

specimen plant, it is quite hardy and tolerates a wide range of soils.

Big-tooth Maple (*Acer grandidentatum* Nutt. ex Torr. & A. Gray) Height 20' - 30'

Primarily native to moist canyons in the foothills and mountains of Utah and Arizona, this tree should be in demand once people see it. The attractive dark green leaves with three rounded lobes turn brilliant red, orange and even light yellow in autumn. Rather slow-growing and quite dense, the big-toothed maple prefers well-drained soils.

Amur maple (*Acer ginnala* Maxim.) Height 20'

Amur maple is a spreading shrub or small tree often multi-stemmed. Flowers are inconspicuous and the dry, winged fruit turns red in midsummer contrasting with the dense, fine-textured green foliage. Autumn color ranges from brilliant red to scarlet. It is a good tree or shrub for screening, group plantings, or as an accent.

Newport Plum (*Prunus cerasifera* Ehrh. 'Newport') Height 20'

With deep purple summer foliage that is best in full sun, this plum with its rounded top makes a good specimen tree. It can be grown multi-stemmed. Crossing branches tend to develop and should be pruned out. Very small rose-pink flowers bloom in spring before the leaves appear and the inconspicuous fruit can be used for jelly.

Redbud (*Cercis canadensis* L.) Height 20'

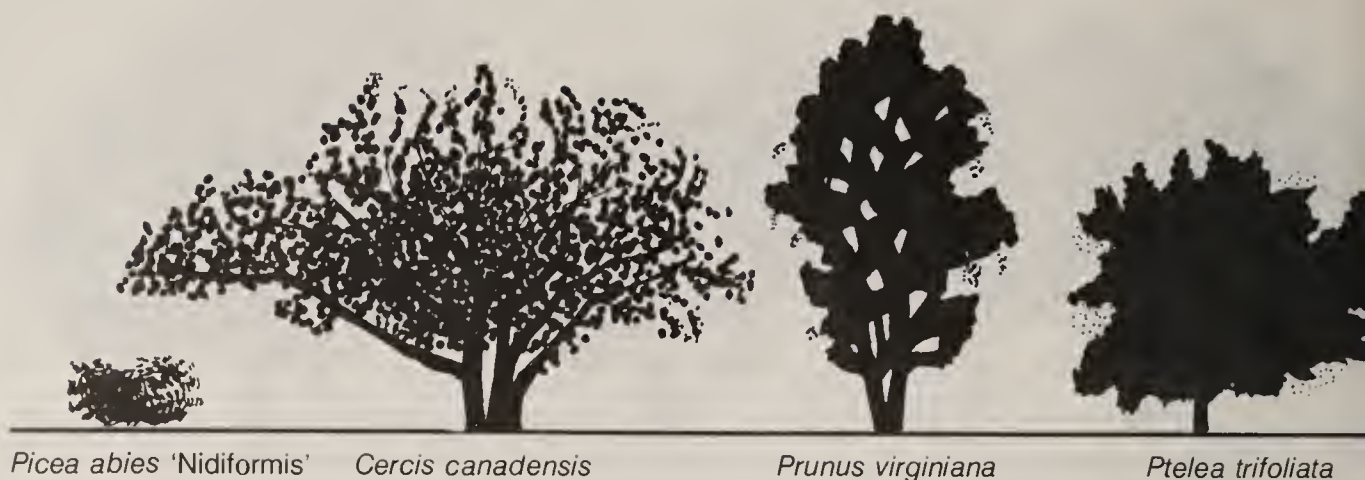
The redbud, a favorite of many gardeners, may need a protected north or east site especially in newer areas. However, some on southern exposures have survived to be quite old. Perhaps someone was wise in giving them good winter care, such as mulches and protection from sunscald the first few years. This tree is often multi-stemmed and rather spreading with a flat top. The small purplish-pink, pea-like flowers in clusters often bloom for Mother's Day. A variety 'Alba' with white flowers is, perhaps, not as hardy. Heart-shaped leaves turn yellow in autumn. Many newcomers, familiar with this tree in other regions, have sent for it, and it is becoming available locally.

Shubert Chokecherry (*Prunus virginiana* L. 'Shubert') Height 20'

This selection out of the common chokecherry is very hardy. Young growth is green with leaves turning reddish-purple as they mature. The small white flowers in terminal racemes develop into small dark fruits that can be used for jelly. This interesting and colorful tree may be used for contrast in group plantings or screens. Since it spreads by root suckers, and if a single stemmed specimen is desired, the new shoots must be continually pruned off while young.

Wafer ash (*Ptelea trifoliata* L.) Height 15'

Wafer ash can be a shrub or small tree. As a tree, it is somewhat rounded with



low branches, and once established will thrive in dry sites. Leaves are lustrous dark green in summer and yellow to yellowish-green in autumn. Greenish-white inconspicuous flowers precede the dry fruit consisting of a seed enclosed in a round paper-like “wafer” which is attractive as it persists into winter. This interesting plant would be effective in shrub borders and can be grown in shade.

Temperate Fruit Trees

Even though the constancy of yield does not always occur, certain fruit trees can be an addition to the landscape. Many semi-dwarfs and full dwarfs are available. Apples, sour cherries and plums are the best choices, followed by sweet cherries, peaches and pears. Apples currently have the greatest size range available because of dwarfing root stocks. One should select those with a suitable maturity season and chilling requirement for our fickle climate, and be aware of pest problems, pruning techniques and other cultural considerations. With these things in mind, one can enjoy growing them—unless the yield of fruit is expected each year!

Evergreen Trees

Birdsnest Spruce (*Picea abies* (L.) Karst. ‘Nidiformis’) Height 3’

This spruce is a very slow-growing, dense, broad plant. The name “birdsnest” comes from its usually having a small depression in the center of the plant. It is

suited for a protected location in very small areas or rock gardens.

Dwarf White Spruce (*Picea glauca* (Moench) Voss ‘Conica’) Height 10’

Another popular dwarf spruce, this tree also needs the more protected locations. It is a very compact pyramidal plant. The foliage is light green and the needles radiate around the stem. It would be good for tight spots with the right exposure—probably north or east.

Bristlecone Pine (*Pinus aristata* Engelm.) Height 25’

A regal, elegant pine, the bristlecone makes a beautiful tree as a specimen or in groups provided they are not too close together. The deep green needles speckled with white resin are in clusters of five. Many years’ growth of needles are held on the tree giving it a dense, full look. With branches low to the ground, the tree often lacks strong dominance or a main leader. This give it an attractive asymmetrical shape. Pests are not a great problem and it is fairly drought resistant, but requires well-drained soils. The tree has potential for heights beyond 30 feet, but it is slow growing, and its use on the plains may deter this growth in height.

Pinyon Pine (*Pinus cembroides* var. *edulis* (Engelm.) Voss) Height 20’

The pinyon pine, an evergreen tree with short needles, retains good color year around. It usually appears shrubby with branches close to the ground, and is useful in screens, windbreaks and group



Picea glauca 'Conica'

Pinus aristata

Pinus cembroides edulis

Juniperus virginiana

plantings. If shaded too much, the foliage becomes thin. It is drought resistant and thrives in well-drained, relatively dry soils. This tree should not be planted in a lawn where frequent watering is detrimental, especially in heavy clay soils. Pests can be a problem when this tree is under stress.

Junipers (*Juniperus* L. spp.)

Height 15' - 30'

The backbone of our evergreen plantings which offer color year-round, junipers are effective in screens, windbreaks and group plantings. Some selections available serve well as specimen plantings. All need well-drained soils and watering must be considered throughout the year, especially in heavy clay soils.

Most of the selections locally are from Rocky Mountain juniper (*Juniperus scopulorum* Sarg.), eastern red cedar (*Juniperus virginiana* L.), and Chinese juniper (*Juniperus chinensis* L.) with many cultivars available.

Leaves are usually small and scale-like with colors ranging from green hues through silver-gray and blue. Some change to brown, yellow or purple in winter, but others retain their summer hues. Forms vary from slender to broad plants. Sexes are usually separate and only female trees will bear the round blue berries—a real attraction in fall and winter. A male tree should be in the area to assure fruiting.

If junipers are planted with proper spacing, minimal pruning will be

necessary to maintain the natural look. However, shearing is acceptable if done correctly and at the right times. Usually most berries will be lost with the shearing.

The list of trees described here could be greatly expanded. Some may be too risky for some people, and none is perfect. There is need for as much genetic diversity as possible. When we narrow the selections to one or two types of trees, we become vulnerable to pest problems. Preferably the local nurseries should have a demand for a dozen or more different tree species as opposed to only three or four.

Continued support to facilities in this area where new trees and shrubs can be grown to maturity is invaluable. There people can see many selections and learn how they perform in our region. Trees and shrubs play a critical role in the value and environment of our homes, neighborhoods and communities.

In evaluating trees for your use, consider not only space, but also the beauty these trees can offer through every season of the year.



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Woody Heaths Native to Colorado

by William F. Jennings

In a previous article (*The Green Thumb* 41(2):61-64) on the 18 representatives of the Ericaceae (heath family) in Colorado, nine herbaceous species that are sometimes spun off in a separate family (Pyrolaceae) were discussed. All nine of these herbaceous species are found in the Front Range area.

Here the remaining nine species are discussed. All are woody plants; three are not found in the Front Range, but only in areas remote from Denver. These nine species represent five genera: *Kalmia*, *Rhododendron*, *Vaccinium* (3 species), *Gaultheria*, and *Arctostaphylos* (3 species).

Kalmia

Probably the showiest of the Colorado ericads is bog laurel, *Kalmia polifolia* Wangenheim. It is widely distributed in the subalpine regions of Colorado, often growing on little hummocks just above the general level of the bogs in which it grows. It blooms early for a subalpine plant, usually the last week of June or the first week of July, before the heavy summer visitor usage of late July and August. Perhaps that is why it is not seen



Kalmia polifolia

often even though it is relatively easy to find. Photographing the plant in its natural setting is a bit of a challenge, since one must usually stand ankle deep in the muck of the bog—even wetter than usual because of the high snowmelt at this time of the year.

K. polifolia has numerous showy pink umbrella-shaped flowers. The anthers held in pouches on the corolla are readily released when ripe by an insect's weight. The flower is very fragile; sometimes just a touch will dislodge it from its stem. The bog laurel is easily found adjacent to the south shore of Long Lake west of Brainard Lake in Boulder County.

William F. Jennings specializes in photographing all the members of one plant family he can find and does extensive research to determine the natural distribution of those species. Though his primary concentration is in Colorado, he extends his search to other western states as well.

Rhododendron

Colorado's sole member of this genus, *Rhododendron albiflorum* Hooker, is found only in the Park Range, which forms that part of the Continental Divide that is the county line between Jackson and Routt counties. Although far from common, there are several localities where it can be seen. Harrington (1954) indicates *R. albiflorum* has been collected several times in the Park Range at 9,000-11,000 feet, during July and August.

The Colorado native rhododendron is a woody shrub, commonly 3 feet tall. Unlike many ericads, it loses its leaves in the fall. The flowers are creamy white, often with a blush of pink, and campanulate (bell-shaped) much like the cultivated rhododendrons or azaleas but smaller.

Vaccinium

Plants in the genus *Vaccinium* have many common names: whortleberry, grouseberry, bilberry, huckleberry or, most usually, blueberry. In Colorado there are three species of blueberry, all of which produce edible fruit. In *Edible Native Plants of the Rocky Mountains*, H. A. Harrington gives a good discussion of

the plants, their fruit, and some recipes. However, he cautions that in the high mountains of Colorado, the blueberries rarely set abundant fruit.

The three species seem to have nearly identical descriptions, but when seen in the field, the differences are readily apparent. All have small urn-shaped flowers.

Vaccinium cespitosum Michx. is probably the smallest of the three. The plants observed have not been taller than 3 or 4 inches. The main distinguishing characteristics are leaves that are widest above the middle, that is, a rounded kite-shape instead of oval, and branches that are round in cross-section. Additionally, the flowers are a little longer than the other two vacciniums, but the difference is very slight. The ripened fruit is blue.

V. myrtillus L., probably the most common of the Colorado blueberries, is distinguished by its oval-shaped leaves at least $\frac{3}{8}$ inch long and widest at the middle and often somewhat reddish and translucent. The branches are not round in cross-section; that is, there are grooves or "flutings" on the branches that make them feel "bumpy" when rolled between the thumb and forefinger. In addition, the



Rhododendron albiflorum

grooves of the branches are puberulent (finely hairy), but seeing this requires a strong handlens.

V. scoparium Leiberg has grooved or fluted branches similar to *V. myrtillus*, but the grooves are not puberulent. Its leaves are almost never over $\frac{3}{8}$ inch long and do not seem to show the reddish bloom. In fact, when seen together, *V. scoparium* seems rather sickly with its small pale leaves compared to the robust *V. myrtillus*. The most interesting distinguishing characteristic is the decidedly "broomy" growth habit of *V. scoparium*. Usually the branches are so crowded as to look like a living miniature wiskbroom. The flowers are whiter and shorter than the other two, but again differences are very slight. The mature fruit is red.

A good place to see all three species is along the north side of Long Lake on the Pawnee Pass trail at the point where the nature trail diverges to go around the west end of the lake. Look for the plants under the pines, spruces, or willows in reasonably well protected spots. They should be in bloom the last two weeks of July almost anywhere in the subalpine forest of the Front Range.



Gaultheria

Members of genus *Gaultheria* are the wintergreens known for their distinctively flavored leaves. Our representative is *G. humifusa* (Graham) Rydb., a low, creeping plant of the subalpine zone. Leaves are nearly circular, about the size of a dime, and branches are little thicker than heavy thread. This small, fragile, dainty plant is so inconspicuous it seems to totally fade into the subalpine forest background and, thus, is often difficult to find. It is worth looking for, not so much for the chewable leaves or edible red berries as for the very attractive small dainty flowers.

Look for it in bloom about the last two weeks of July in the Long Lake area associated with the three kinds of blueberries.

Arctostaphylos

There are three species of *Arctostaphylos* in Colorado. The taller shrubby varieties are called mazanitas, particularly in the Southwest or California. Locally, the best known species is a creeping ground cover (*Arctostaphylos uva-ursi* (L.) Sprengel) and is commonly called kinnikinnick or bearberry, a translation of the Latin specific name, *uva-ursi*. Kinnikinnick is a very common plant of burned over, rocky, or disturbed ground in the foothills and montane zones to about 10,000 feet. The plant has thick, leathery, evergreen leaves that are widest above the middle and rarely over $\frac{3}{4}$ inch long. Blooming in late May or early June depending upon altitude and exposure, the flowers are the familiar inverted vase shape typical of so many of the Ericaceae. By late July, fruit is well developed and looks like miniature pea-sized green apples. Upon ripening the fruit becomes red.

The other two species of *Arctostaphylos* are not found in the Front Range, but only in the far western reaches of the state. *A. patula* Green ssp. *platyphylla* (Gray) Wells has been collected on the Uncompahgre Plateau, southwest of Grand Junction and Delta and in the Dinosaur National Monument area of



Arctostaphylos patula

Moffat County at around 8,000 feet. This manzanita is quite shrubby and erect, about 2½ feet tall at a minimum. The brownish-red bark is smooth; the leaves approach being circular with a very slight point, somewhat reminiscent of the ace of spades. The flowers are similar to those of kinnikinnick, perhaps a little pinker, and the mature fruit is creamy white.

Look for this shrub to bloom in June along Divide Road, the main road along the crest of the Uncompahgre Plateau. Divide Road leaves Colorado Highway 141 (the Unaweep Canyon Road) about 10 miles southwest of Whitewater, Colorado.

A. nevadensis Gray var. *coloradensis*

(Rollins) Harrington is a much smaller but still shrubby plant, about 1 to 2 feet tall. The branches spread and often take root forming a dense, but miniature thicket. Bark is brownish-red and smooth. The leaves are quite distinct, being an elongated egg-shape, with the leafstalk attached at the narrow end. The flowers are of the familiar shape, being white or pink; the fruit is red. This manzanita can be found associated with *A. patula* on the Uncompahgre Plateau and blooms at the same time. Harrington (1954) reports the two hybridize to add to the confusion.

It is hoped that these two articles have stimulated interest in these beautiful, but generally hard to photograph plants. Of the 18 species discussed, 15 are Front Range natives and only two species are really rare. Most should be encountered again and again if sharp watch is kept. Happy hunting! ❁

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Vaccinium scoparium

The Green Thumb — 40th Anniversary

by Bernice Petersen

Since completion of the Rock Alpine Garden and its alpine house, Denver Botanic Gardens has been able to offer visitors and members the opportunity to study and enjoy the world of plants from "tropics to tundra" around the seasons and all within an 18-acre site.

Not only was the Rock Alpine Garden in the spotlight during the past decade, 1974-1983; but the Scripture Garden, Herb Garden expansion, Home Demonstration Garden, Rose Display Garden, Shofu-en—the Garden of Pine Wind, the Plains Garden and the Bird Mound became realities and were described in the magazine as well. *The Green Thumb's* pages provided: an introduction to the orchid-bromeliad pavilion which shelters one of our country's finest collections of these exotics; an insight into DBG's mycological treasures; a preview of the opportunities for growth through "Horticulture in Therapy and Rehabilitation."

Cemetery to Conservatory, "the tale of how Denver's green dream came true" as reviewed in the Rocky Mountain News, was begun in 1976 to commemorate Colorado's Centennial. Louisa Ward Arps' entertaining history of the land around Denver Botanic Gardens, 1859-1978, was told in seven issues of the magazine and later combined in book form with "A Jubilee History of Denver Botanic Gardens 1851-1976" from the Annual Report, 1975.

Bernice Petersen, charter member of the Associates of Denver Botanic Gardens, was named Honorary Editor of *The Green Thumb* in 1973 in recognition of her many years of volunteer work on the magazine. She continues to serve on the editorial committee.

"Botanists on Colorado Peaks," "About Seeds and Seedsmen," "Colorado's Horticultural Pioneers," "The Clements in Colorado," "Centennial Tree Watching," "Harison's Yellow Rose," "Old Fashioned House Plants" were also part of our celebration of the Centennial.

"A Garden for Molly Brown" was described and the story of Botanic Gardens House was told.

Two founders of DBG, George W. Kelly and M. Walter Pesman, were profiled during the decade; among others were Colorado botanists H. D. Harrington, T. C. A. Cockerell, and Ruth Ashton Nelson.

"Focus On" considered plants from A to V, abutilon to vanilla. Irises were the focus of the magazine honoring the convention of the American Iris Society here. "A Phlox Adventure," a tribute to T. Paul Maslin and his plant introductions and a "Guide to the Common Wildflower Families of Colorado" were part of the issue recognizing the American Rock Garden Society meeting in Colorado.

In tune with our times were "Landscaping for Energy Conservation," and an issue devoted to living within our water means, as well as features on drip irrigation and soil building plants. Trees, shrubs and perennial charts for a variety of landscapes were listed. Grapes, small fruit trees, berries for the plains and for high altitudes were evaluated. The culture of peonies, water lilies, penstemons and daylilies, miniature and other hybrid roses popular for this area were discussed. Such natives as poison hemlock, alpine anemone, birch and maple, even a garden of natives in Colorado Springs were detailed. Also noted were discoveries or redescouvertes of a *Nolina* species, some native orchids and oaks new to science in Utah.

A survey of the plant communities at our outpost in the montane zone above Evergreen and a checklist of the vascular plants at Chatfield Arboretum, became part of our botanical heritage.

One hundred years ago the Colorado Forestry Association was formed to protect our forests from destruction, and in 1944 when the Forestry Association merged with the Denver Society for Ornamental Horticulture to become the Colorado Forestry and Horticulture

Association *The Green Thumb* was born. During the 40 years since its beginning, *The Green Thumb* has disseminated volumes of practical horticultural information. It has provided a permanent record of the dreams of many visionaries whose long crusade recently culminated in a 25th anniversary celebration of ground breaking on York Street for the Denver Botanic Gardens—a sparkling jewel in her crown for Denver, Queen City of the Plains. ♀

Projecting the Future for Denver Botanic Gardens

The festivity marking our first 25 years of Denver Botanic Gardens was a lovely tribute to some farsighted idealists who had a vision of what could come of an abandoned cemetery west of York Street and east of Cheesman Park. Our 10-day *Fête des Fleurs* was indeed a celebration for our many members and visitors.

So where do we, the Denver Botanic Gardens, go from here? While most of our gardens at the York Street site are planned and planted, there are still some gaps, most notably the Xeriscape or dryland plantings garden and the Fragrance garden. The former has been planned by the Gardens' staff, but is being publicized and partially financed by the Denver Water Board. Hopefully both gardens will be under construction in 1985. In addition some sculptural pieces on long term loan from the Denver Art Museum will be installed in 1985. Such inter-agency cooperation is valued. Also some consideration will be given on whether it is best for us to have gardens of only one genera or variety (e.g., Iris), for, when the blooming season is past, a rather noticeable hole appears in our overall scheme.

The planning committee is deliberating about future lighting schemes

for both evening use and demonstration purposes. There will never be enough parking for such events as the Plant Sale or the summer evening concerts. Currently much of our south side parking during the summer is taken by people using the city park just east of us, an issue we will have to address in the near term if we expect visitors to come to the Gardens. Also to be addressed is our need for some type of restaurant or eating facility.

Recently I appointed a committee of Trustees to serve as the Long Range Planning Steering Committee. This group will make recommendations to the Board of Trustees who will consider both board and staff concerns and interests for the future. Key to their discussions will be proposals for innovative financing of the Gardens, not already in action. The Mayor's office is presently considering the feasibility of a metropolitan-wide mill levy which would include the Gardens, the Zoo, Natural History and Art Museums. I heartily support such an idea; for such a proposal, while it would go a long way in solving City finances and the difficulties of meeting our operating budget requirements, would require enabling legislation from the Colorado Legislature and approval from

surrounding county commissioners. Certainly, this will be a formidable task.

Few beyond the Trustees know how large a part the Denver Botanic Gardens Foundation plays in keeping our gardens going and open to the public. Without the Plant Sale, Christmas Sale, many other special events, and the marvelous yearly contributions from the Gift Shop, Denver Botanic Gardens would literally not be able to stay open. Recently we employed a new director of public relations to attract more and different groups to the Gardens. He, as well as our active and pressured development department, are vital in pursuing as yet unexplored ideas for generating additional funds to balance rising costs. Our two years of concerts co-sponsored by KCFR are successful ventures which should be continued.

Will we need additional offices and classroom space? Inevitably, yes. Do we combine a new building on land to the north of our fine library with additional multi-level parking? All of these areas will be explored, and more. . . .

This past summer we finally computerized one area of operation, our vital plant lists of some 17,000 species. But, still to be done will be library cataloguing; herbarium and mycological collections, along with finances, billing, bill paying, and budgeting; word processing; and planning. This was made possible by a large anonymous gift.

Beyond the York Street property, the Botanic Gardens owns or leases three varied properties and operates the Mt. Goliath Natural Area in conjunction with the US Forest Service. Now that most of the large projects are finished at York Street, much time and money will have to be invested first in one of those properties—the Chatfield Arboretum site. For fifteen years the Chatfield committee has labored under limited resources while large portions of our income helped to develop the York Street Gardens. There is a fine and detailed master plan prepared for the Chatfield Arboretum. There are now four different committees working on various projects at Chatfield. If ever the master plan is to

be completely implemented, many millions of dollars will be required to convert this 300 acre piece of High Plains to an area for growing trees on an experimental and educational basis. More water will be needed to supplement what we already have.

The challenge is great, but it is heartwarming to see how many of our good volunteers are willing to respond to that challenge which will not be finished until well into the next century. We won't live to see our end product, but what satisfaction to know that we started. How often does one have a chance to plan and start a major garden complex such as ours? When can we open the Chatfield Arboretum to the public? What will we have to show? How many employees—all to be financed by the DBG Foundation—will we need to maintain and supervise plant collections and visitors? Certainly Chatfield will require a major part of our resources and energy over the next years.

It was very gratifying to me that, at the fund raising events of the *Fête*, those individuals who have done so much in our past chose to earmark the funds raised for Endowment of the Future. It is tempting to say, "Let's relax and reap the enjoyment of what 25 years of hard work did." But, we have much more to do to make our already outstanding Botanic Gardens among the best in this nation and the world. We are well on our way under the supervision of our excellent director, Merle Moore. I look forward to our future with great gusto as do so many others of our loyal staff and invaluable volunteers. If you're not actively involved in DBG's future now, do you care to be? You can gain much satisfaction and pride by being involved in the programs of the Gardens in the next 25 years and beyond. I would be very grateful for your input and ideas; for good, innovative ideas are a scarce commodity.

Edward Connors

President, Board of Trustees
Denver Botanic Gardens

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